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Walleye Feasibility Study: Moberly and Gwillim Lakes

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PART I

INTRODUCTION

1.0 OBJECTIVES

This study was commissioned by the Peace Sub-Region of the British Columbia Ministry of Environment (MOE) to provide information which will be used in the design and implementation of fisheries enhancement and management programs for Moberly and Gwillim Lakes. The focus of the study was to assess the potential of each lake to support a viable walleye population based on the Habitat Suitability Index (HSI) model (McMahon *et al.* 1984) but sampling was expanded to facilitate evaluation of other sport fish in the two lakes.

The program objectives were given as follow:

a. Assess the fisheries habitat characteristics of Moberly and Gwillim Lakes (and associated tributaries) with specific regard to the suitability of these lakes for walleye.

b. Determine the suitability of Moberly and Gwillim Lakes for the introduction/stocking of walleye employing the Habitat Suitability Index model produced by the U.S. Fish and Wildlife Service or comparable alternative.

c. Determine the status of current sportfish populations in both lakes and provide estimates of standing crop of each species.

d. Based on modelling results, provide recommendations re proceeding with development of walleye fisheries in Moberly and Gwillim Lakes.

e. Predict the impact of development of walleye fisheries on current sportfish populations in both lakes.

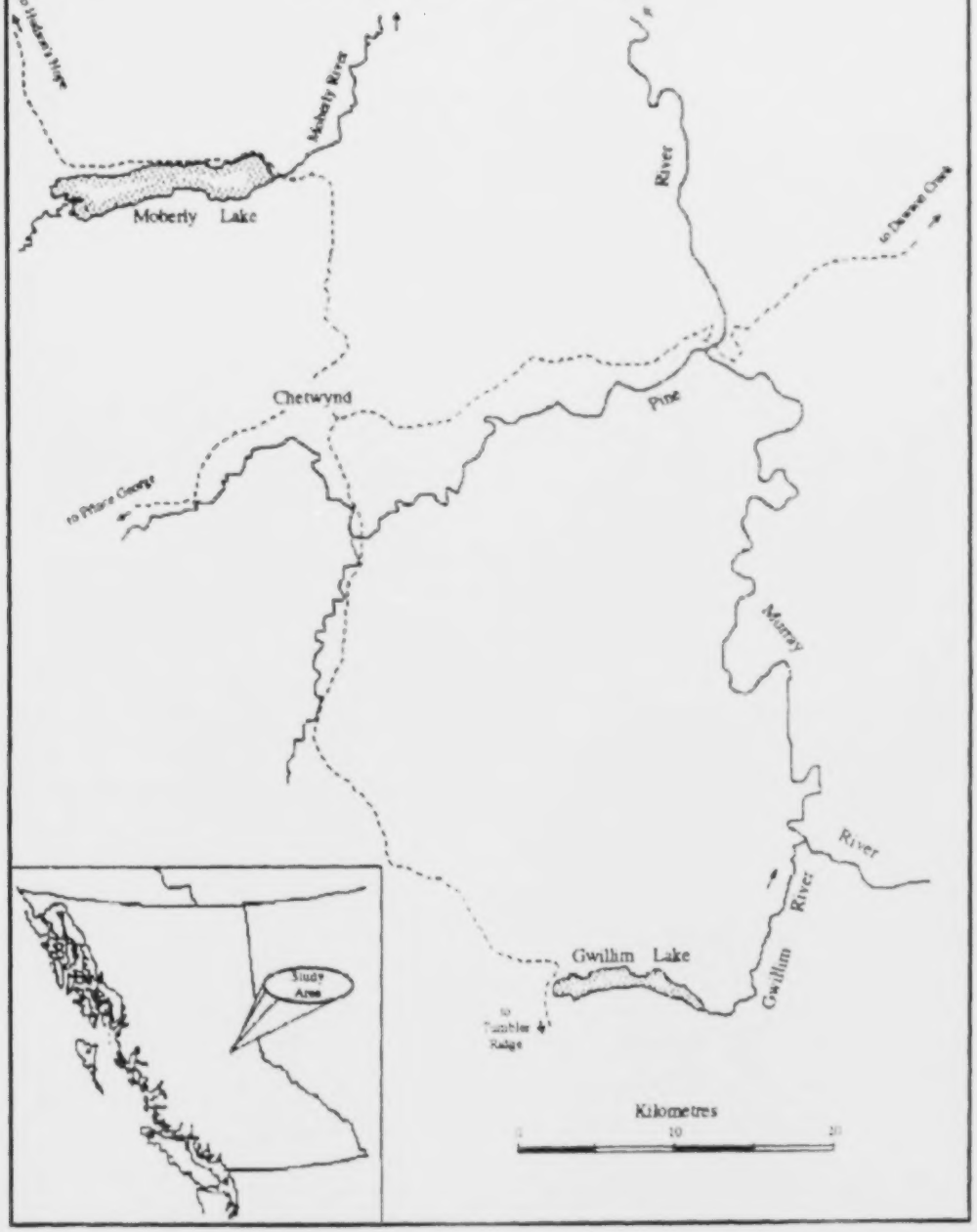
1.1 STUDY LOCATIONS

Moberly and Gwillim Lakes are located in the boreal white and black spruce biogeoclimatic zone of northeastern British Columbia (Krajina 1965, Figure 1). Moberly Lake drains into Moberly River which joins the Peace River near Fort St. John. Gwillim Lake drains into the Gwillim River which flows into the Peace River via the Murray and Pine systems.

1.2 PREVIOUS WORK ON STUDY LAKES

Both lakes have been sampled at irregular intervals by staff of MOE and its predecessors. Standard gillnet and water qualify samples from Moberly Lake were taken by Lindsey et al. (1957) and Balkwill (1959). Balkwill's sampling included a

Figure 1.
Moberly/Gwillim Study Area



bathymetric survey. Additional sampling including vertical temperature and dissolved oxygen profiles, invertebrate collections, and gillnet sets was conducted by M.R. Whately and G.W. Nielson in 1968. Gwillim Lake was sampled in July 1976 by Burns and Stratis (1976). Their work included a bathymetric survey, water quality sampling, vertical temperature and dissolved oxygen profiles, and gillnetting.

PART II

METHODS

2.1 LOGISTICS

The sampling program was conducted in three main sessions: October 12 - 19, 1989, June 6 - 12, 1990 and August 9 - 21, 1990. Fish catches were low during the August session so an extra gillnetting session was added in September 24 - 30, 1990. Weekly water level and temperature observations were made during the winter of 1989/90.

2.2 WEATHER

Climatic information is available from the Atmospheric Environment Service (AES) station at Chetwynd (AES station 1181508, Chetwynd, Figure 1). The station has been operating since 1971 so that conditions during the 1989/90 study year can be compared with those of the previous 18 years. It is located about 30 m lower than Moberly Lake, only 13 km distant and is thus fairly representative of conditions at the lake. It is however less representative of conditions at Gwillim Lake which is 40 km distant and 90 m higher in elevation.

2.3 TRIBUTARY AND OUTLET HYDROLOGY

Major inlet streams were examined briefly with the objective of evaluating their utility to spring spawning sport fish. Detailed habitat assessments were not made but major characteristics such as substrate type, flow conditions and obstructions were noted using FHIIP methods and criteria (DFO/MOE 1987).

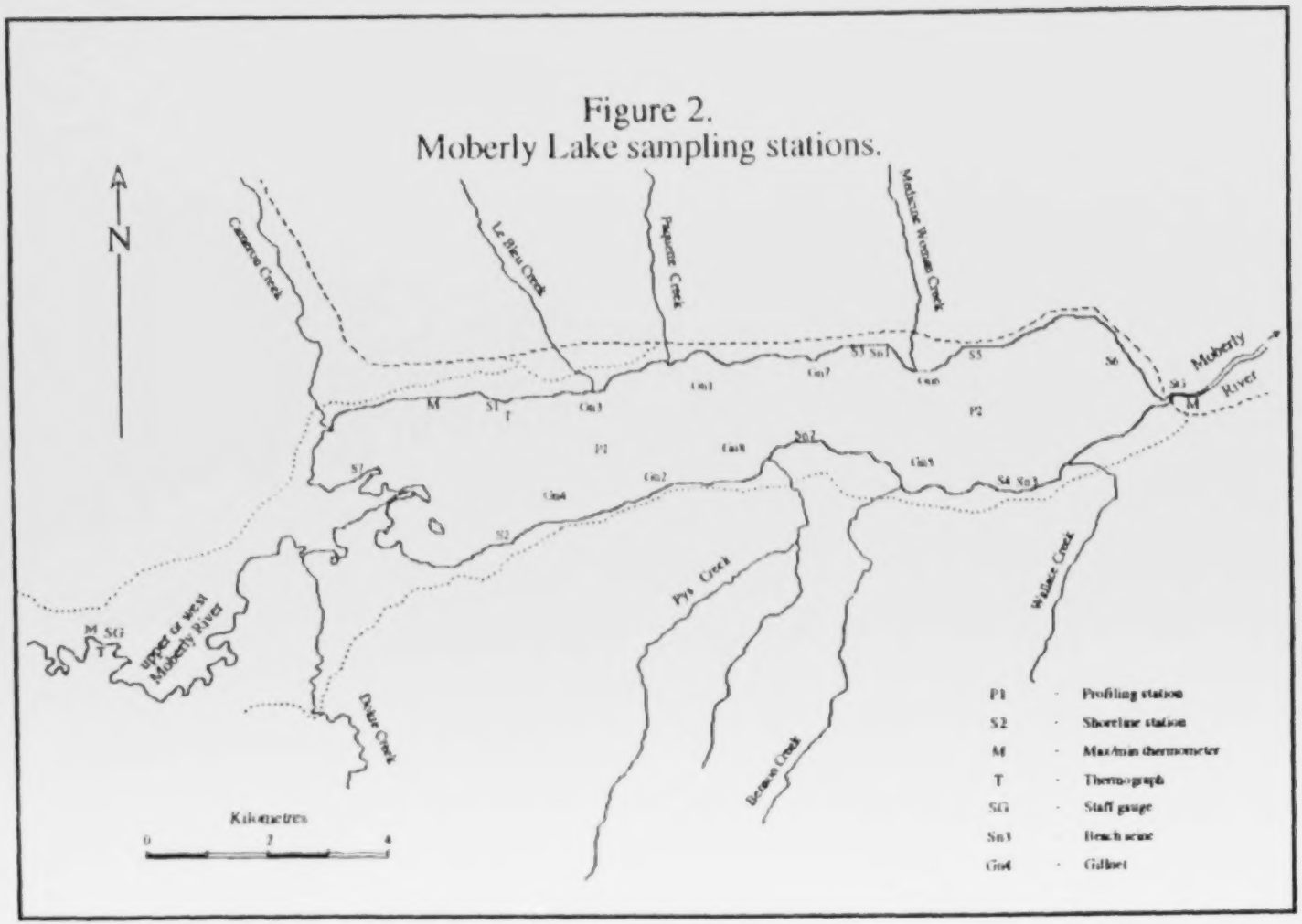
Ryan tempmentor thermographs were installed in the West Moberly River about 4 km above its mouth, and in Smokehouse Creek about 1 km upstream from Gwillim Lake (Figures 2 and 3). These meters recorded temperatures (±0.1 °C) at hourly intervals throughout the winter and spring. A staff Gauge and a max/min thermometer were also installed on the Moberly River near the thermograph. These were read at weekly intervals.

2.4 MORPHOLOGY

Gross physical information including basin volumes and bathymetries were taken from earlier MOE surveys (Balkwill 1959, Burns and Stratis 1976). Additional information on substrate composition and weed cover was obtained during October 1989 and August 1990 sampling sessions.

During October 1989, while turbidity was low, a boat was used to transport an observer around the perimeter of each lake. At regular intervals (approximately

Figure 2.
Moberly Lake sampling stations.



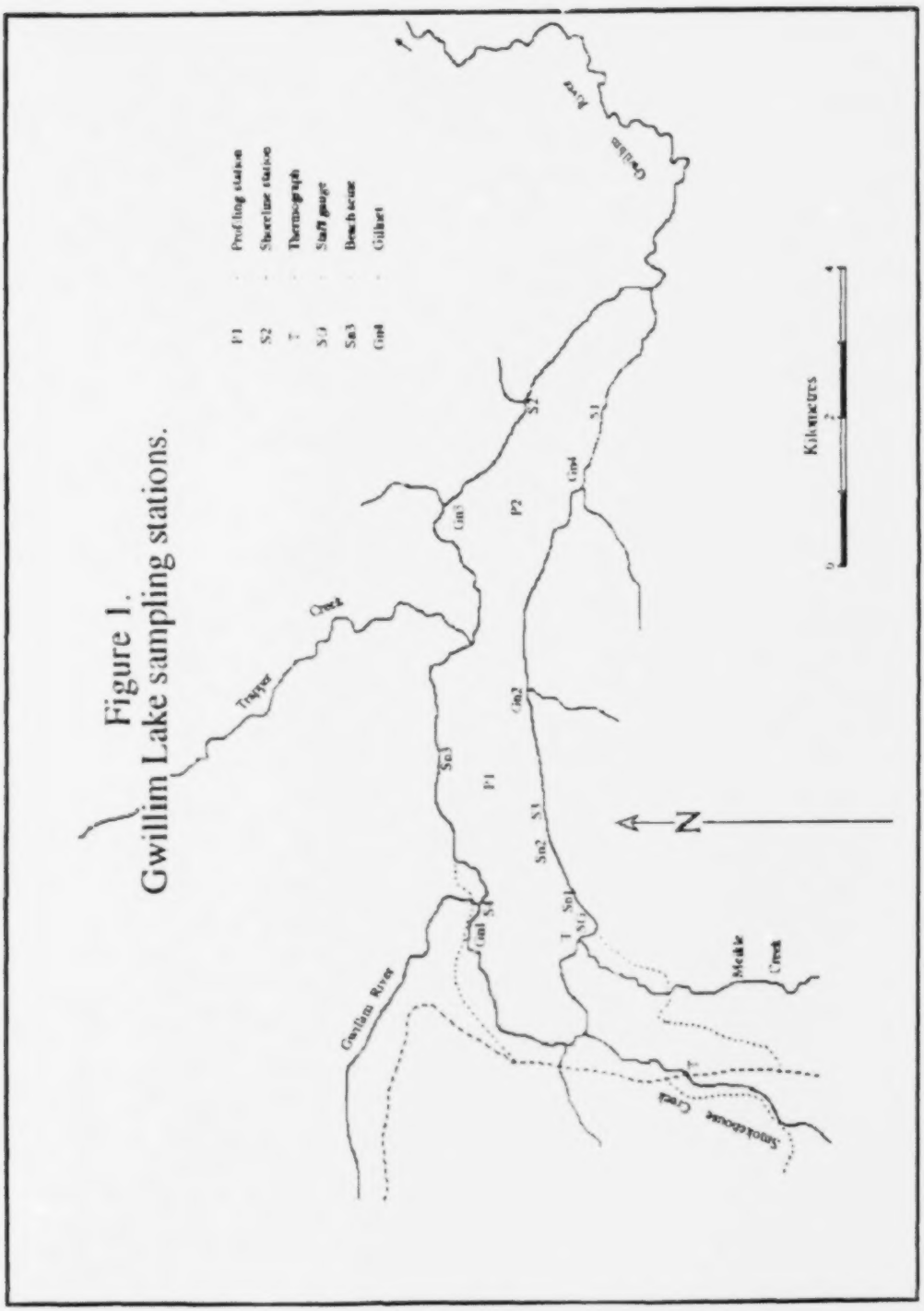


Figure 1.
Gwillim Lake sampling stations.
P1 Profiling station
S2 Shoreline station
T Thermograph
S1 Staff gauge
Se3 Beach crest
Gul Gilbert
Trapper Creek
Gwillim River
Middle Creek
Shoreline Creek
Kilometres
N
P1
P2
S1
S2
S3
Se1
Se2
Se3
Gul1
Gul2
Gul3

510 m on Moberly Lake and 325 m on Gwillim Lake), the 1 m isobath was probed, and the substrate composition (% fines, gravel, cobble, boulder) was estimated using the criteria of the Stream Survey Field Guide (DFO/MOE 1987). For the HSI model it would have been preferable to separate the estimates of the silt and sand components of the fine fraction. However, water clarity made this distinction impossible. Distance from the shore to the 1 m isobath at each station was estimated visually.

Aquatic plant densities were estimated during the August sampling session when they were expected to be near the annual maximum. Estimates of total cover including weed, algae and woody debris were made at each of the shoreline sampling stations (Figures 2 and 3).

Shoreline development (Wetzel 1975) was calculated from existing lake data (Balkwill 1959, Burns and Stratis 1976) as follows:

$$D = L \cdot (2(\pi A)^{1/2})^{-2}$$

Where L is the perimeter of the lake and A is the surface area.

2.5 PHYSICAL LIMNOLOGY

A water column profiling station was established near the deepest point in each lake (Figures 2 and 3). These points were determined from existing MOE mapping and depths measured with a Furuno LE-4000 depth sounder (±0.1 m). Temperature profiles were taken with a Hydro Lab TC-2 marine thermometer (±0.2°C). Water samples for oxygen and pH determinations were drawn from 0, 5, 10, 20, 30, and 40 m depths with a Van Dorn bottle. These samples were decanted to standard BOD bottles and preserved for dissolved oxygen by Winkler titration (Strickland and Parsons 1972). Samples were titrated to the nearest 0.1 mL and were completed within 4 hours of sample collection. Water samples for pH determination were taken from surface and maximum depths. These samples were stored in clean 2 L PVC bottles and pH (±0.05) was determined within 4 hours using a Fisher model 91 pH meter.

Lake levels and temperatures were monitored with recording thermometers and staff gauges. On the Moberly system, the staff gauge was placed on a bridge piling in the Moberly River at the outlet of Moberly Lake (Figure 2). The Gwillim Lake gauge was placed near the eastern most dock at the outdoor school (Figure 3). Ryan 'tempmentor' recording thermometers were installed in both lakes using a double anchor system so that the meters were tethered at the 5 m level in 10 m of water. The Moberly Lake meter was installed near the north shore, 1.5 km west of

the mouth of LeBleu Creek. The Gwillim Lake gauge was installed near the south shore, 100 m east of the mouth of Meikle Creek. The meters were set to record water temperatures (±0.1 °C) at hourly intervals. Back-up water temperature data was derived from maximum/minimum thermometers which were placed on the dock at Gwillim Lake and on the outlet bridge at Moberly River. Temperatures and water levels were read at weekly intervals throughout the program.

2.6 SHORELINE CONDITIONS

Water quality sampling stations were established around each lake in areas where coarse substrates appeared to offer suitable habitat for spring spawners and at representative sites in the shallows at the ends of the lakes (Figures 2 and 3). At these stations, temperatures were measured with a calibrated pocket thermometer before pH and oxygen samples were taken. pH and oxygen determinations were made as described earlier.

2.7 WATER CHEMISTRY AND LAKE PRODUCTIVITY

Water samples were taken with a Van Dorn bottle at the surface and near bottom depths at the two water column sampling stations in each lake during the summer sampling session. Samples were decanted to clean PVC bottles, packed in ice and expressed to Zenon Laboratories in Vancouver. There, they were analyzed for total dissolved nitrogen, total dissolved phosphorous, suspended solids and other, inorganic parameters (APHA 1975).

Productivity assessments included comparison with Vollenweider's (1968) standards and calculation of MEI (morphoedaphic indices, Ryder et al. 1974).

$$MEI = TDS\, z^{-1}$$

Where TDS is total dissolved solids ($mg \cdot L^{-1}$) and z is mean depth (m).

2.8 FISH

2.8.1 Forage fish

Forage fish in the study lakes were sampled by beach seining in representative nearshore habitats and by trawling and sounding in deeper waters. Tributaries were sampled by electroshocking (Smokehouse Creek) or seining (Moberly River).

Seining sites on the shores of the study lakes were selected to represent the major habitat types present. On Moberly Lake these included a lightly weeded cobble shore, a deeper weed free shore and a heavily weeded bay (Sites 1-3, Figure 2).

On Gwillim Lake, the sites included a shallow weedy area and a deeper site with gravel substrate and little weed (Sites 1-2, Figure 3).

The shore habitats were sampled with a 26 m x 3 m seine of 1 cm stretch mesh with a bunt of 0.6 cm mesh using a 6 m boat. All sets were made at night in order to maintain a consistent catch efficiency and to maximize catches of larger fishes. Following each set, the length, width and mean depth of the area swept were estimated.

Deeper waters were sampled using a two boat trawl system similar to that described by Gjernes (1979) and Hyatt et al. (1984). A 2.5 x 1.8 m trawl with a length of 7 m was lowered from one boat and towed by a second. The tow boat was a 5 m skiff equipped with an 18 hp outboard. The trawl was constructed of meshes graduating from 4.5 cm (stretch) at the mouth down to 6 mm at the cod end. Trawls were made at night and included 10 minute transects with the top of the trawl at surface, 4.6 and 9.7 m depths. Volume estimates for the tow samples were based on the mean speed reported by Hyatt et al. (1984) for tows with similar nets at the same 17° warp angle.

Fish abundance in the deeper waters were also estimated by sonar. The acoustic surveys were subcontracted by Canadian Biosonics Ltd. Their methods are described in Appendix VI and in Burczynski and Johnson (1986).

Fish densities in Smokehouse Creek, were estimated by the multiple removal technique (Seber LeCren 1967) using an electroshocker and stop nets. Although the Moberly River was very low when sampled on August 9, some of the deeper pools were of sufficient size to permit setting the 26 m seine as described previously.

Catches were sorted, identified, and in most cases all of the fish were measured (total ±1 mm) and weighed. Smaller fish (<150 g) were measured on an electronic balance (±0.03 g) while larger fish were weighed by calibrated spring scale (±0.1 kg). Where large numbers of fish of a similar size were encountered (n>25), a subsample was weighed and measured.

2.8.2 Sportfish

Sportfish populations in both study lakes were sampled at near shore stations, in deeper waters, and in major tributaries during August, 1990 (Figures 2 and 3). Additional deep water sampling was conducted in September, 1990.

The deeper waters of both lakes were sampled by 76.2 m x 1.5 m gillnets graduated mesh from 2.5 cm through 10 cm. These were generally set perpendicular to the shore near inlet streams. During the August session, sets were made in both shallow (1 - 5 m) water, typically frequented by pike etc., and in deeper waters (10 - 30 m) used by lake char. Few lake char were very captured in August so additional deep water gillnetting was conducted in late September.

Catches were measured in the manner described previously for forage fish. Additional sampling from sport fish catches included scale samples (whitefish, lake char, rainbow trout and Arctic grayling), cliethra (northern pike), and otoliths (lake char, bull trout and burbot). Scale samples were aged by Aquatic Resources Ltd. staff following the criteria of McKay et al. (1990). The Ministry of Environment aged the pike cliethra and contracted North South Consultants to analyze the lake char, bull trout and burbot otoliths.

2.9 WALLEYE HABITAT SUITABILITY

The suitability of Moberly and Gwillim lakes as walleye habitat was assessed using the Habitat Suitability Index(HSI) methodology developed by the U.S. Fish and Wildlife Service (Schamberger et al. 1982). Among this series, the HSI model specifically developed for walleye (McMahon et al. 1984) was employed to predict the likelihood of a successful walleye introduction (and in turn enhance each recreational fishery). This version continues to be widely used and no changes have been made since 1984 (Jim Terrel, pers. comm. June 22, 1989).

Although the walleye HSI model was developed from more southern waters, it is to our knowledge, the only comprehensive technique currently available that assesses the suitability of a naturally-occurring water body based on quantitative habitat measurements.

As defined, the HSI is a numerical index that represents the capacity of a given habitat to support a selected fish or wildlife species. In general, an "index" is the ratio of a value of interest divided by a standard of comparison (Inhaber 1976). The HSI is defined as the estimate or measure of habitat conditions in a study area divided by the optimum habitat conditions for the species of concern:

$$HSI = \frac{\text{study area habitat conditions}}{\text{optimum habitat conditions}}$$

Accordingly, the HSI can have a value ranging from 0 (totally unsuitable habitat) to 1.0 (optimum habitat).

0.0 - 0.1 = Poor
0.2 - 0.4 = Fair
0.5 - 0.7 = Good
0.8 - 1.0 = Excellent

Furthermore, the range of index values between 0 and 1 produced by the HSI model assumes a direct linear relationship between the HSI value and habitat carrying capacity (i.e., a unit change in HSI corresponds to an equal change in carrying capacity units).

The walleye HSI model is based on five life requisites:

1) food
2) cover
3) water quality
4) reproduction
5) other factors (i.e., lake productivity)

Habitat suitability for each walleye life requisite was assessed by obtaining values for the following 14 variables at Moberly and Gwillim lakes (13 variables for upper (west) Moberly River and Smokehouse Creek).

1) Food

V_1 - Average transparency (Secchi depth) during summer.

V_2 - Relative abundance of small forage fish (<12 cm) in spring and summer (mg-prey·m^{-3}: fry, juvenile and adult). This was calculated as a weighted mean from prey captured in each habitat type — limnetic (0-10 m) trawls conducted in June and August and littoral seining in August (see Section 3.8.1). Average prey densities for each sampling method was weighted by the estimated lake volume for each habitat type.

2) Cover

V_1 - Average transparency (Secchi depth) during summer.

V_3 - Percent of water body with cover (i.e., boulders, submerged vegetation, log piles etc.) and adequate dissolved oxygen (>3 mg·L^{-1}) during spring and summer (fry, juvenile and adult). Percentage cover in lakes was calculated for the littoral zone by adjusting

measurements obtained at the 1 m isobath. Cover estimates for both lakes were adjusted downward because the sample estimates for percent cover were, in our opinion, positively biased. Mean cover values suggested optimal conditions which did not actually exist Weed beds at the ends of the lakes provided overly dense cover while the sides of both lakes provided far too little cover foraging walleye.

3) Water Quality

V4 - Lowest suitable pH during year.

V_5 - Minimum dissolved oxygen above thermocline in summer for lacustrine environment (juvenile and adult). Minimum dissolved oxygen in pools and runs for riverine environment.

V_6 - Minimum dissolved oxygen during summer-fall along shallow shoreline areas (fry).

V_8 - Mean weekly water temperature above thermocline (lacustrine). Mean weekly water temperature in pools (riverine).

V_9 - Mean weekly water temperature in shallow shoreline areas during late spring-early summer (fry).

4) Reproduction

V_7 - Minimum dissolved oxygen measured in spawning areas during spring (embryo).

V_{10} - Mean weekly water temperature during spawning in spring (embryo).

V_{11} - Degree days where water temperatures are between 4 and 10°C from Oct 30 through Apr 15. Calculated by multiplying daily water temperatures in the range 4 - 10°C by the number of days that temperatures are in this range.

V_{12} - Spawning habitat index. (Calculated by multiplying the proportion of the water body composed of riffle or littoral areas >0.3 m but <1.5 m deep by the substrate index which is defined as: 2(% gravel/rubble 2.5 to 15 cm) + (% boulders/bedrock) + 0.5(% sand) + 0.5(% dense vegetation) + 0(% silt and detritus).

V_{13}- Water level during spawning and embryo development:

A) Rising or normal stable (abundance of shallow shoreline or shoal areas for spawning).

B) Low (many spawning areas are exposed and never inundated).

C) Fluctuating (fluctuations sufficient to alternatively expose and flood spawning areas).

5) Other

V_{14} - Trophic status of lake or lake section (adapted from Leach et al. 1977): mesotrophic - optimum; oligotrophic and eutrophic - sub-optimum. Spring was defined from ice off (mid-April) to June 21, late spring/early summer was mid-May through mid-July, summer was late June through late September, and fall was late September through November.

The Suitability Index (SI) for each variable was calculated in accordance with the graphical procedures outlined by McMahon et al. 1984). The five life requisite index values were then calculated as follows:

1. Food = $\frac{V_1 + V_2}{2}$

2. Cover = $\frac{3V_1 + V_3}{4}$ for Secchi transparency <3.4 m

= $\frac{3V_1 + NV_3}{3 + N}$ for Secchi transparency >3.4 m

where $N=10(1\text{-SI of } V_1)$

3. Water Quality = $\text{Min}(V_4, V_5, V_6, V_8, V_9)$

4. Reproduction = $\text{Min}(V_7, V_{10}, V_{11}, V_{12}, V_{13})$

5. Other = V_{14}

Finally, HSI = Min(Food, Cover, Water quality, Reproduction, Other)

PART III

RESULTS

3.1 WEATHER

Temperatures during the 1989/90 study year were near normal at Chetwynd although December 1989 and March 1990 were somewhat warmer than usual (Figure 4). The frost free period was 117 days in 1990 which was well above the 97 day average for this location, but well within the 72 - 141 day range of the previous 18 years (AES, Vancouver data base).

Total precipitation at Chetwynd was only 7% less than normal over the study year however the distribution was unusual. Rain and snowfalls were generally below normal during most of the winter and later summer. However, the difference was made up in May and June when rainfall was well above normal (Figure 4).

3.2 TRIBUTARY AND OUTLET STREAMS

The major tributaries of the study lakes were briefly examined to determine their utility as spawning and early rearing habitats for lacustrine fishes. Most significant among these were the upper (west) Moberly River and Smokehouse Creek on the Gwillim System. Both continued to flow all winter and appeared to provide a variety of suitable habitats. The other tributaries were generally very small and contained flows only during spring and early summer. Their utility was in most cases limited by unstable substrates and the absence of pools.

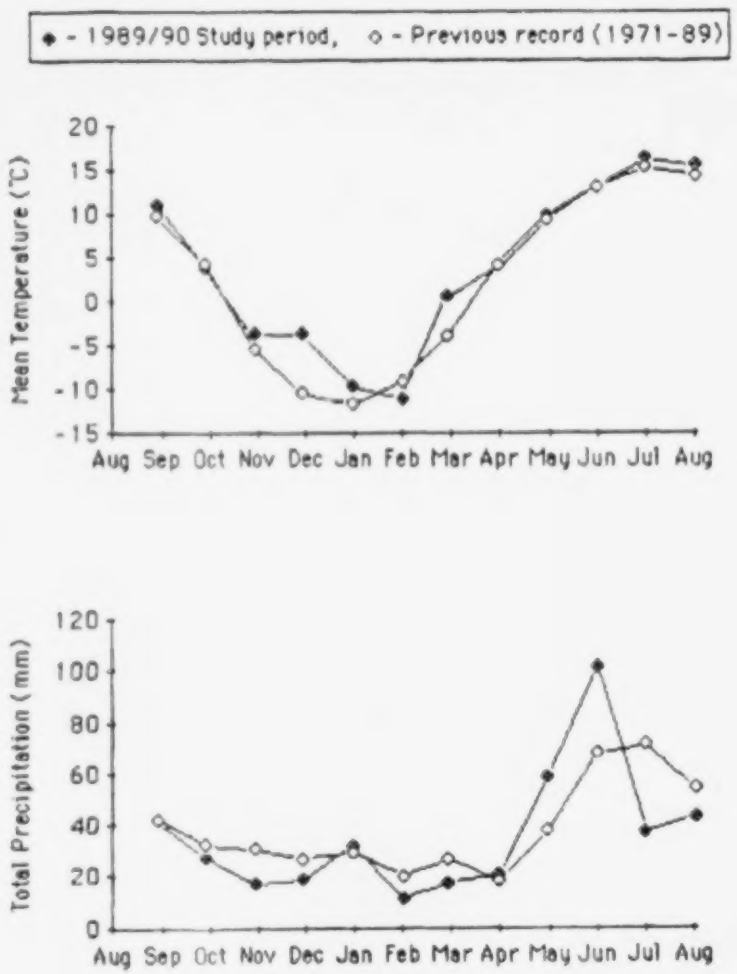
3.2.1 Moberly Lake tributaries

The Moberly Lake watershed covers an area of 1,100 km^2. The western portion of the area includes peaks 2,000 m in height while the eastern half lies within the foothills where rolling hills average 900 - 1,100 m. The foothills portion of the basin is drained by small creeks including Cameron, LeBleu, and Medicine Woman creeks on the lake's north shore (Figure 2) and Wallace, Benson and Pys Creeks to the south. Most of the western, higher elevation, portions of the watershed are drained by the Moberly River which flows into the west end of the lake.

Moberly River

The Moberly River (commonly known as the 'west Moberly'), which is Moberly Lake's largest tributary, drains about three quarters of the lake's total watershed. The river originates near Rosetta Ridge in the Rocky Mountains and flows 110 km north east to the lake. The lower 10 km of this distance are at very low gradient with tortuous meanders which increase the stream length considerably. Both banks

Figure 4.
Temperature and precipitation
at Chetwynd, B.C. (AES 1181508).



and substrates are >95% fines (Plate 1). Crown cover ranges from 10 - 20% while cut banks and large organic debris provide an additional 15% cover.

When the thermograph was installed on the Moberly River in November, 1989, water temperature was 0°C and depth at the staff gauge was 1.04 m. Within a week the river had frozen over. With the exception of a few warm days in December which brought meltwater flowing over the ice, the Moberly River remained ice covered until late March (Figure 5). Ice on the river broke up on March 28 and temperatures began to rise slowly. Warming increased rapidly after April 10 with the daily mean increasing from 0.9 to 5.0°C over a period of a week and the afternoon maximum reached 9.1°C on May 3.

Water levels in the west Moberly River rose steadily through the spring from 0.8 m on March 28 to 2.0 on April 11. Water level records during the spring are unfortunately incomplete: in April the access road washed out and in May the gauge was over topped. However, the freshet appeared to peak June 7 when water level was estimated at 4.5 m. (Figure 6). By August, the level of the Moberly River had declined to 1.0 m.

Water temperature was 6.5°C and dissolved oxygen was 10.1 $mg \cdot L^{-1}$ (90% saturation) at 1905 hrs on June 11, 1990 just after peak freshet at a station 1 km above the river mouth. Secchi depth at this time was estimated to be <0.2 m although measurement was difficult as the disk disappeared almost immediately. When the station was sampled again on August 11, temperature was 23°C, dissolved oxygen was 7.8 $mg \cdot L^{-1}$ (98%), pH 7.9, and the Secchi depth had increased to 1.5 m.

The June freshet buried the Moberly River thermograph with approximately 0.2 m of silt (Figure 5). However, weekly measurements with the maximum/minimum thermometer indicated the river reached a summer maximum of 25°C in the week of August 8 and had a diurnal range of approximately 10°C through most of the summer.

Cameron Creek

This system is stabilized by two small lakes and has year round flows. However, fish migrations are blocked by a large number of beaver dams. Substrates in the low gradient lower reaches are too fine to be used by most sport species.

LeBleu Creek

The system offers little habitat. The first reach above the lake is low gradient and has a largely mud substrate (Plate 2). Migrations to higher gradient areas above the highway are blocked by an impassable culvert.

Plate 1

Riparian vegetation extends 2 - 3 m out over the channel in the lower reaches of the Moberly River (above). Further upstream, near the staff gauge, the channel winds sinuously between 2 - 3 m banks of mud and silt (below).

Figure 5.
Water temperatures in west Moberly River
and Smokehouse Creek, 1989/90.

Daily maximum, mean and minimum from hourly observations

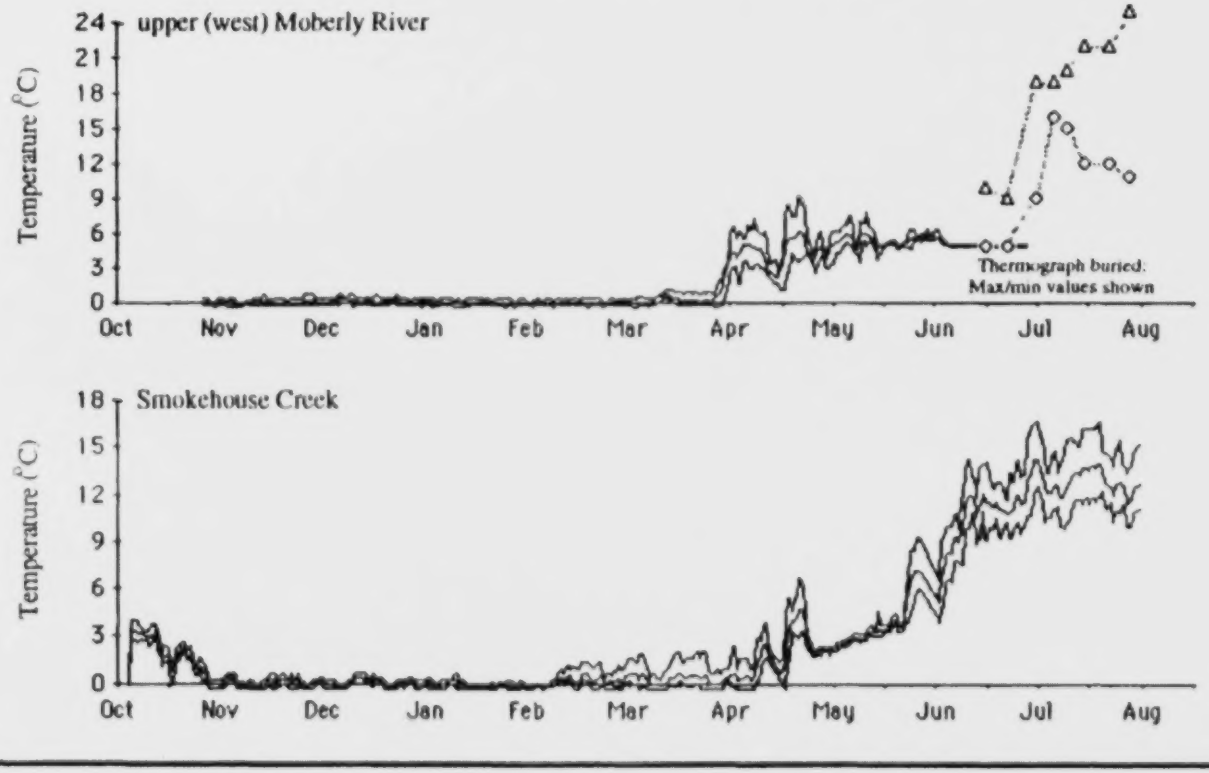


Figure 6.
Spring water levels in the Moberly and Gwillim systems, 1990

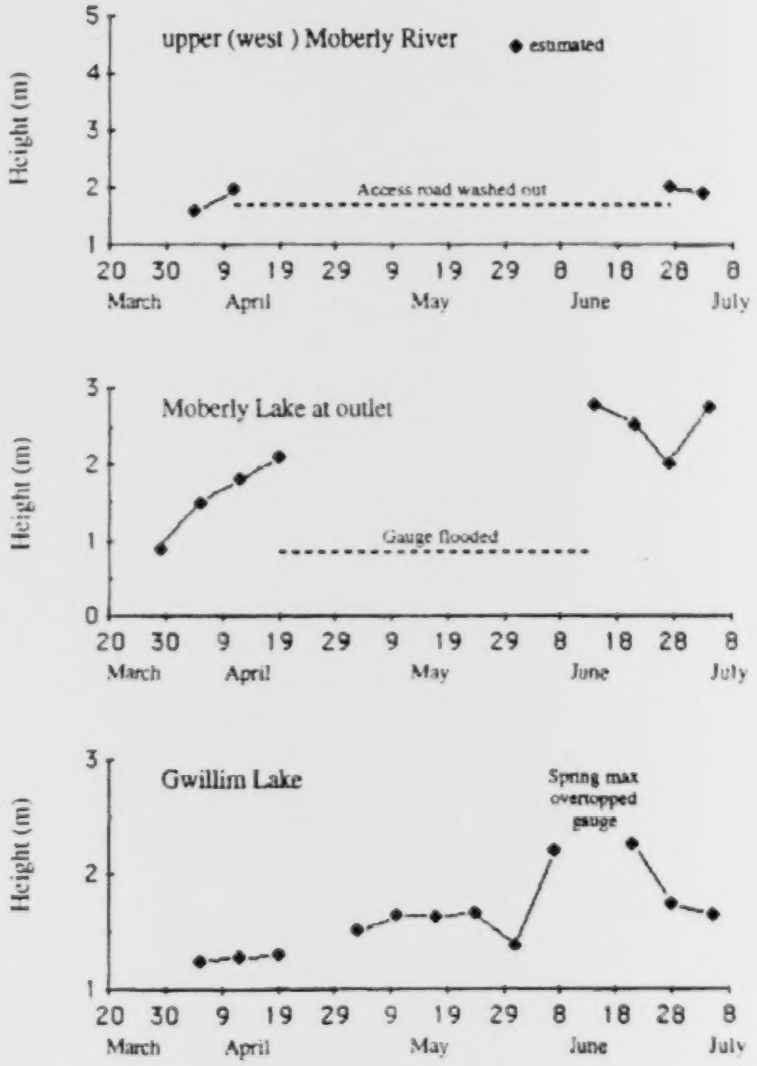


Plate 2

LeBleu Creek has fine substrates and relatively low fishery values. Upstream fish passage is blocked by the highway culvert (above). Medicine Woman Creek has low flow through most of the year but contains some patches of good gravel (below).

Medicine Woman Creek

There are approximately 700 m of accessible habitat between the lake and Medicine Woman Creek's impassable highway culvert. Low flows and an absence of pool habitat limit overwintering. However the substrate of 10% fines, 70% gravel, and 20% cobble could provide habitat for spring spawners (Plate 2). Water temperature was 7.5°C on October 12, 1989.

Wallace Creek

Low flows in this system and an absence of pools limit its utility for late summer rearing or overwintering (Plate 3). However, Wallace Creek has a gravel/cobble substrate which appears moderately stable and may be suitable for spring spawners. The possibility of migration barriers in the lower reaches was not examined.

Benson Creek

Bensons Creek has a gravel/cobble substrate and is slightly larger than Wallace Creek (Plate 3). However, the substrate appears to be unstable and there are few pools. Migration barriers were not investigated.

Pys Creek

Very similar to Benson Creek with a substrate of 15% fines, 50% gravels and 35% cobble (Plate 4). Water temperature was 5.5°C on October 12.

Dokie Creek

This tributary of the Moberly River enters 2.5 km above the lake. Its lower 2 km are low gradient and there are areas of good spawning habitat suitable for either walleye or salmonids. Above the road, the creek begins to climb and the substrate becomes coarser: 15% fines, 10% gravel, 25% cobble and 50% boulder (Plate 4).

3.2.2 Gwillim Lake tributaries

The Gwillim lake watershed is much smaller than the Moberly covering only 435 km^2. Like Moberly Lake, it lies in the Rocky Mountains foothills however the surrounding hills are much higher averaging 1,400 m in elevation.

Smokehouse Creek

Smokehouse Creek flows into the west end of Gwillim Lake from Mount Suprenant. Its first reach, which extends 1.5 km from the lake to the highway crossing (Figure 3), has a substrate of 10% fines, 60% gravel, 20% cobble and 10% boulder with fines slightly more predominant near the lake and boulders increasing at the upper end. Riffle/run/pool proportions were 1/7/2 with the pools averaging 0.4 - 1.0 m in depth (Plate 5). Cutbanks and LOD provided 25% cover while crown closure was near 80%. Moss and epiphytes were common and the water had a slight (glacial?) tint although visibility was >1 m.

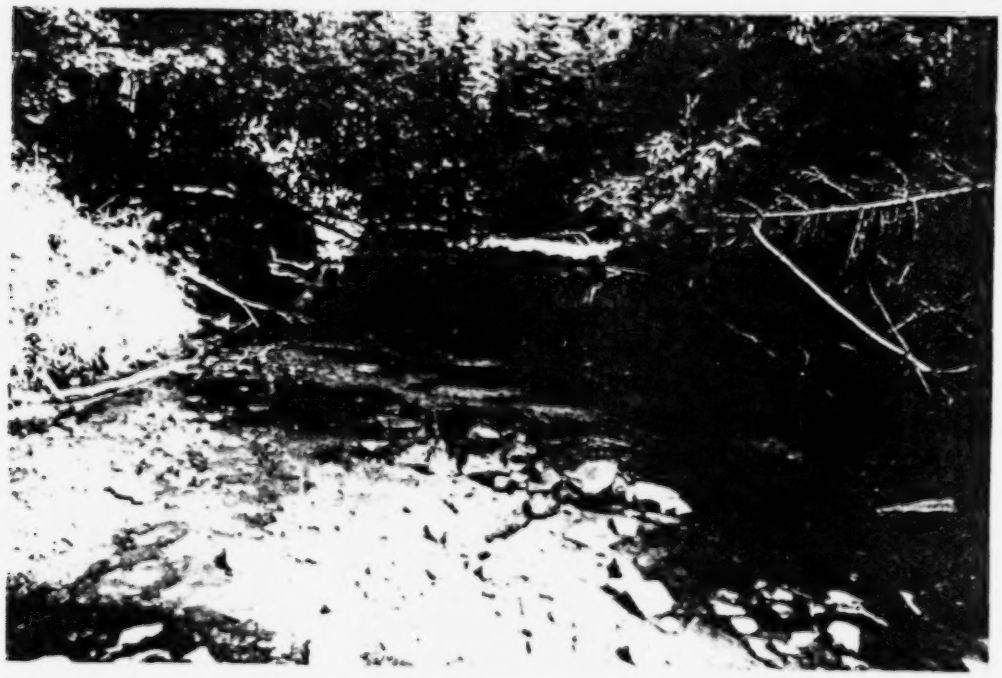
Plate 3
Wallace (above) and Bensen Creeks are small but have good gravel/cobble substrates.

Plate 4

Pys Creek (above) is very similar to Bensen and Wallace Creeks with a fine/gravel/cobble substrate of 15/50/35. Dokie Creek (below) enters the Moberly River four kilometres above the lake. It appears to provide a wide range of substrate and habitat types.

Plate 5

Smokehouse Creek flows all year and supports a wide range of habitat types. The sample site immediately below the highway (above) had a relatively fine substrate.



Smokehouse Creek was 4.5°C on October 13, 1989. It dropped rapidly and remained near 0°C through most of the winter (Figure 5). Temperatures began to rise in late February reaching an afternoon high of 6.7°C by May 3, 1990. The system first reached 10°C on the afternoon of June 16, and had a mean temperature of 10°C by June 21. Maximum temperature recorded was 16.6°C on the afternoon of July 30, 1990.

On June 11, during Spring freshet, Smokehouse Creek had a temperature of 8.5°C, pH of 8.01, and 9.9 $mg \cdot L^{-1}$ dissolved oxygen (94% saturation). By late summer the temperature had increased but pH and dissolved oxygen remained high. On August 12, the creek had a pH of 8.07 and 8.9 $mg \cdot L^{-1}$ dissolved oxygen (90% saturation). Secchi depth at that time exceeded all pool depths and was estimated to be ≈3m.

At site 1, 100 m above the highway, and above the influence of a large beaver dam, the creek is unconfined with an August wetted width of 5.4 m, and a maximum depth of 0.8 m with flood signs 1 m higher. Substrate was 20% fines, 50% gravel and 30% cobble. The banks in this areas are 2 m in height and composed of clay and cobble. Instream cover included 10% from organic debris and 5% from cut bank.

At site 2, 100 m below the highway, the creek had wetted and channel widths of 7.0 m, maximum depth of 0.3 m and a 0.4 m bank on both sides composed of mud and boulders. Flood signs indicated that the banks were just topped by water levels which had been 0.4 m higher in the spring. Stream substrate was 30% fines, 30% gravel and 40% cobble.

Highway 29 crosses Smokehouse Creek over a culvert which was constructed to accommodate fish passage (Plate 6). It has baffles along its bottom, and a weir was constructed across the lip of the plunge pool to maintain water heights. However, these structures have been damaged by time and high flows such that fish from the lake are no longer able to access the upper reaches of the creek. This is unfortunate as the system was formerly used by bull trout and rainbow trout (J. Rosenau, local resident, pers. comm.). It is reportedly the only Gwillim Lake tributary which continues to flow all winter.

Gwillim River (inlet)

Above the lake, the Gwillim River is small, shallow, and braided. Substrate is cobble/gravel but appears quite unstable. In the 0.5 km reach below the road crossing, a large amount of recent LOD covers a flood plain 10 - 20 times the

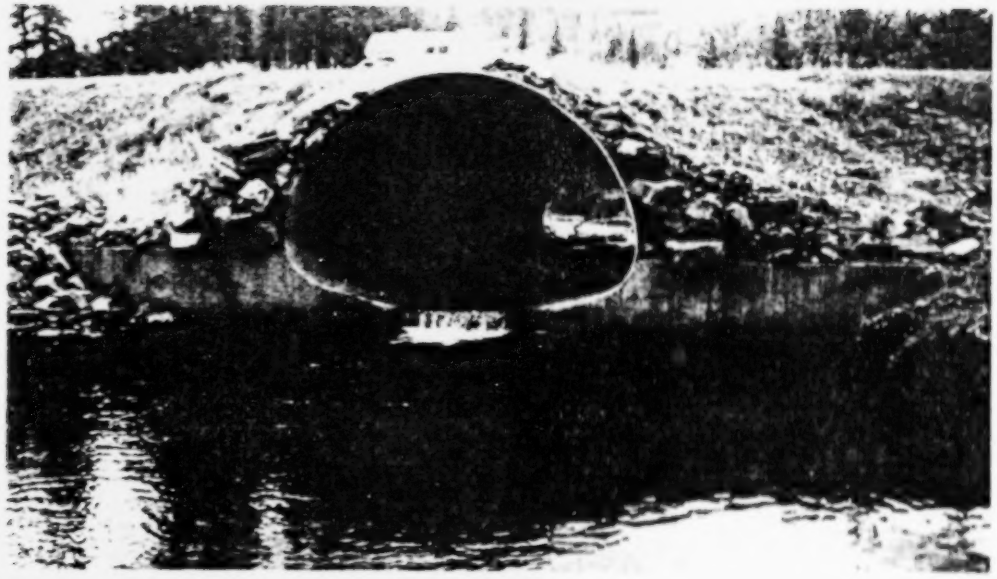


Plate 6

Culvert in Smokehouse Creek at the highway crossing was designed for fish passage but plunge pool erosion has resulted in a barrier (above). Upper Gwillim River contained large amounts of organic debris and appears unstable (below).

current wetted width of 1.4 m (Plate 6). There are no pools >0.5 m in depth and the system appears to be about 80% riffle.

Water temperature was 6°C when the Gwillim River was examined on October 13, 1989. When it was sampled again on June 7,1990 the creek was high but falling. Water temperature was 8.5°C, dissolved oxygen was 9.9 $mg \cdot L^{-1}$ (94% saturation) and pH was 8.2.

The culverts at the road crossing have been rebuilt and appear to accommodate fish passage with bottom baffles and a weir in the outlet pools.

Trapper Creek

Trapper Creek flows south entering Gwillim Lake through a large alluvial fan. The creek appears to be particularly unstable. In its lower reaches, the active channel is >200 m wide although the October wetted width was <2 m and mean depth was 0.2 m (Plate 7).

Meikle Creek

Meikle Creek flows northwest from its source near Bullmoose Mountain and enters Gwillim Lake on the southeast shore. The creek is much larger than the other Gwillim tributaries however it is steep and braided. The substrate is 30% gravel, 60% cobble and 10% boulder. The broad flood plain appears unstable, offers no cover, and few pools (Plate 7). When sampled on June 7, 1990, water temperature was 12°C, dissolved oxygen 9.4 $mg \cdot L^{-1}$ (97% saturation) and pH was 8.3

3.2.3 Lower Moberly River

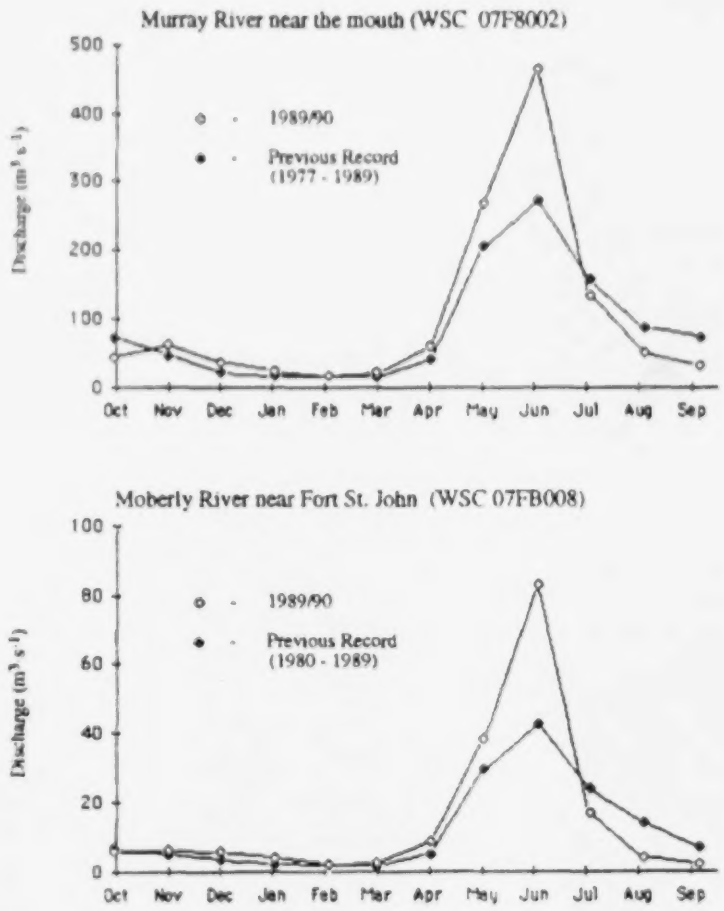
The Moberly River below Moberly Lake has a mean discharge of 12.0 $m^3 \cdot s^{-1}$ most of which occurs during spring and early summer (WSC 1988). The discharge was slightly above average during the winter of the 1989/90 study year but the spring freshet far exceeded previous observations (Figure 7). Heavy rainfalls during May and June (Figure 4) brought the snow pack down quickly and resulted in high discharges that caused major channel movements in the Moberly River below the lake. The monthly averages shown in Figure 7 actually damped the effect; peak daily discharge on June 13 was 146 $m^3 \cdot s^{-1}$, far in excess of the previous daily maximum of 110 $m^3 \cdot s^{-1}$ observed in 1987. Later in the summer, all of the snow being gone, water levels were lower than in previous years.

3.2.4 Murray River

The WSC station on the Murray River near its mouth is the closest gauging station below the outlet of Gwillim Lake. The system is larger than the Moberly River

Plate 7.
Trapper Creek was dry in October but it's broad outwash channel suggests very high flows in spring and extensive bed movement (above). Meikle Creek has a broad flood plain (below) and is braided in some areas.

Figure 7.
Mean monthly discharge at WSC stations on the Moberly and Murray Rivers, 1989/90



with a mean discharge of 85.6 $m^3 \cdot s^{-1}$, but the annual cycle is similar. Like the Moberly River, the Murray River was very high in the spring of 1990 with a June mean discharge of 466 $m^3 \cdot s^{-1}$ compared to a 1980 - 89 mean of 273 $m^3 \cdot s^{-1}$. Rainfall induced an increase in daily discharge from 555 $m^3 \cdot s^{-1}$ on June 11 to 1,010 $m^3 \cdot s^{-1}$ on June 12 which far exceeded the previous daily maximum of 769 $m^3 \cdot s^{-1}$ observed in 1987.

3.3 MORPHOLOGY

Bathymetries of the study lakes are shown in Figures 8 and 9 while their principle characteristics are summarized in Table 1. Gwillim Lake is a two basin system with a maximum depth of 48 m in the west basin and 44 m in the eastern. Moberly Lake is somewhat shallower (43 m) but has a single basin with much greater littoral development.

Table 1
Summary of physical Characteristics

Parameter	Moberly Lake[1]	Gwillim Lake[2]
Elevation (m)	690	790
Surface Area (ha)	2,940	1,120
Volume ($m^3 x 10^6$)	534	346
Mean Depth (m)	18.2	30.9
Maximum Depth (m)	43	48
Perimeter (km)	41.2	24.4
Shoreline Development	2.1	2.1

[1]Balkwill 1959 [2]Burns and Straus 1976

Shoreline development reflects the amount of irregularity in a lake's shape: a perfectly circular basin would have a value of 1. Higher values are significant as they indicate potential for development of larger littoral communities in relation to the overall lake volume. Both Moberly and Gwillim lakes have relatively low shoreline development values which reflects their relatively simple form (i.e. few bays and no islands).

The greatest difference between the two lake systems is in their volume distributions (Table 2, Figure 10). Moberly Lake has a well developed littoral zone and extensive areas of shallows at both ends. The Gwillim Lake shoreline drops steeply and, aside from small areas at the east and west ends of the lake, the littoral zone is quite limited.

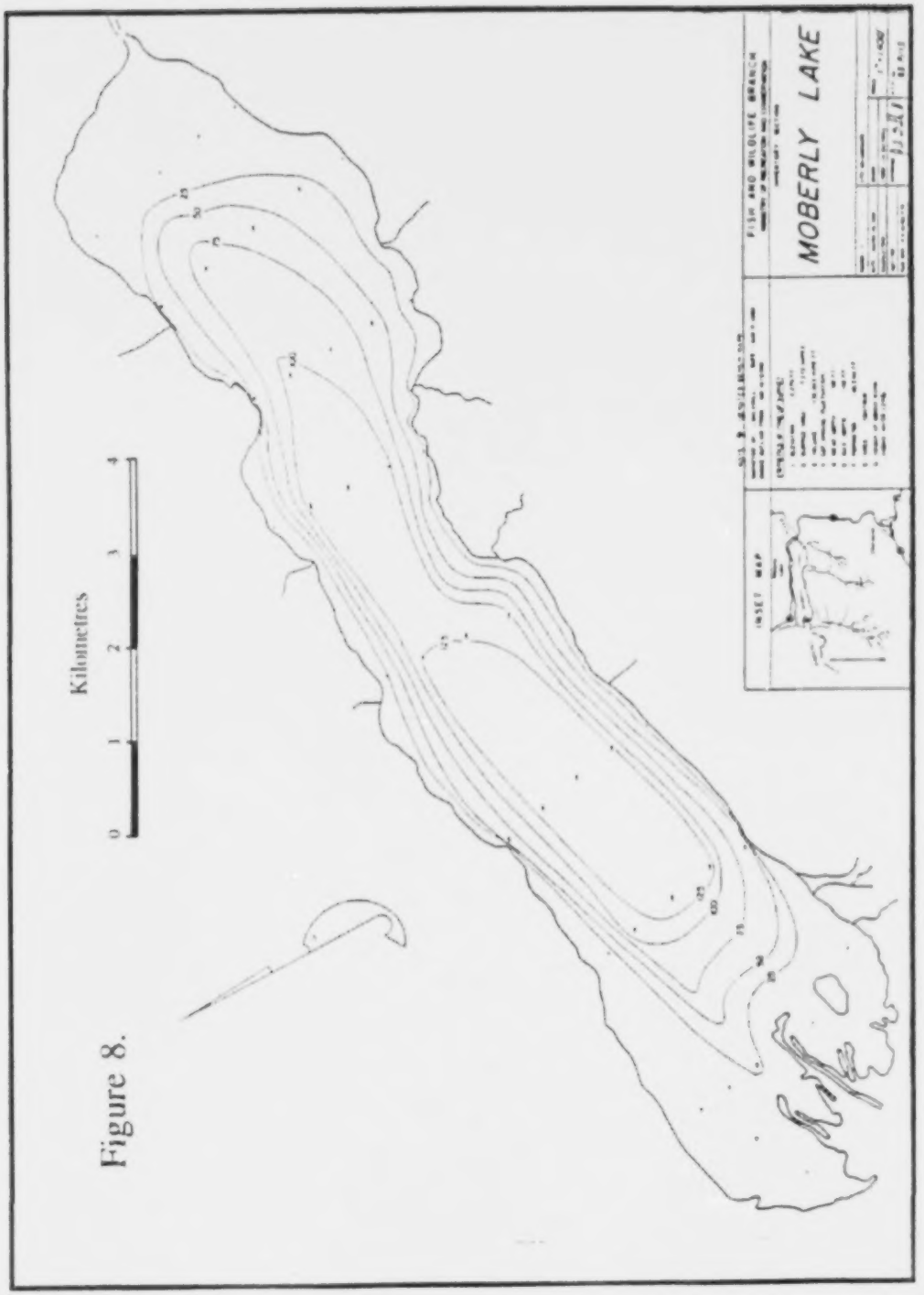


Figure 8.

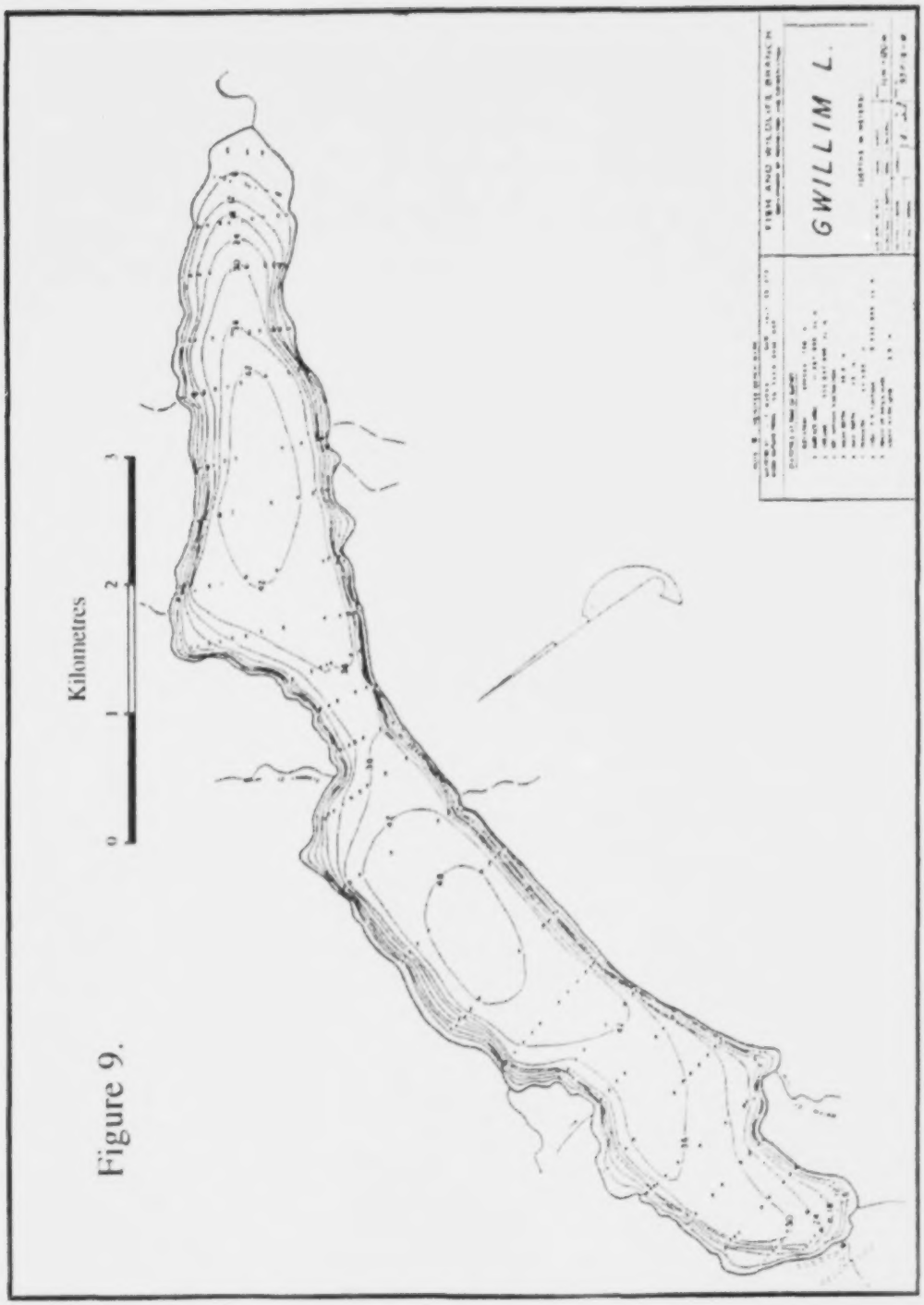


Figure 9.

Figure 10.
Hypsographic comparision of Moberly and Gwillim Lakes.

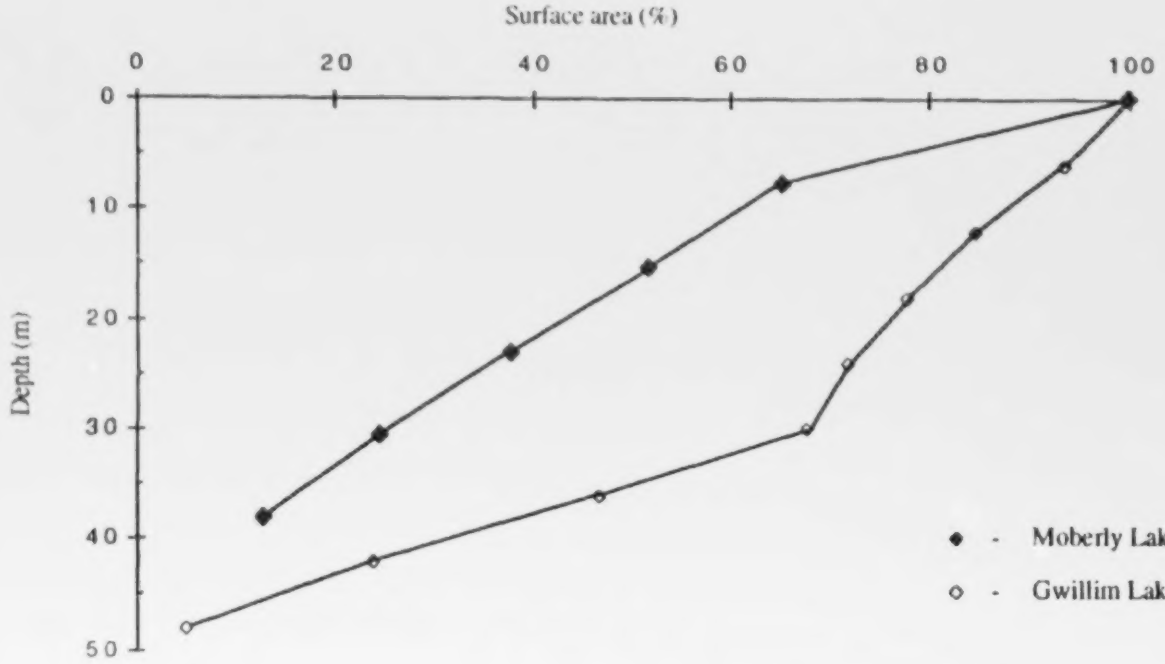


Table 2
Strata size at isobaths in Moberly and Gwillim Lakes.

Moberly Lake		Gwillim Lake	
Depth (m)	Area (ha)[1]	Depth (m)	Area(ha)[2]
0	2,940	0	1,120
8	1,917	6	1,048
15	1,521	12	950
23	1,110	18	873
30	723	24	805
38	373	30	758
		36	522
		42	267
		48	57

[1]Balkwill 1959 [2]Burns and Stratis 1976

The steep nature of the Gwillim Lake shoreline is also apparent in Table 3. Mean distance from shore to the 1 m isobath was 74 m in Moberly Lake but only 17 m in Gwillim Lake. Substrate composition along the shores of the two systems was, however, quite similar with fines (silt and sand) making 53% of both. It should however be noted that substrate sampling stations were not located precisely and that the distance between them tended to get larger on the shallow shoals at the ends of the two lakes. Thus the values in Table 3 may suggest a shoreline which is slightly steeper and coarser than actually exists.

Table 3
Substrate characteristics along the 1 m isobath

Parameter	Moberly Lake	Gwillim Lake
Mean distance from shore (m)	74	17
Fines (%)	53	53
Gravels (%)	18	17
Cobbles (%)	22	25
Boulder & bedrock (%)	8	5
Vegetation (%)	55	55
Cover (%LOD & vegetation)	36	23

The high vegetation values were in both cases due to dense growths in the shallow areas at the ends of both lakes as well as a few sheltered bays (Plates 8 and 9). In general, weeds and vegetation were much scarcer along the north and south sides of both lakes.

Gwillim Lake is approximately 100 m higher than Moberly Lake and the steep slopes of Mount Meikle (1,487 m), limit the amount of sunshine the lake surface

Plate 8.
The shoreline at station S3 (above) was typical of the north and south shores of Moberly Lake with cobble/gravel substrate grading to fines below 1m depth. Dense weed beds develop near the west end of the lake (below).

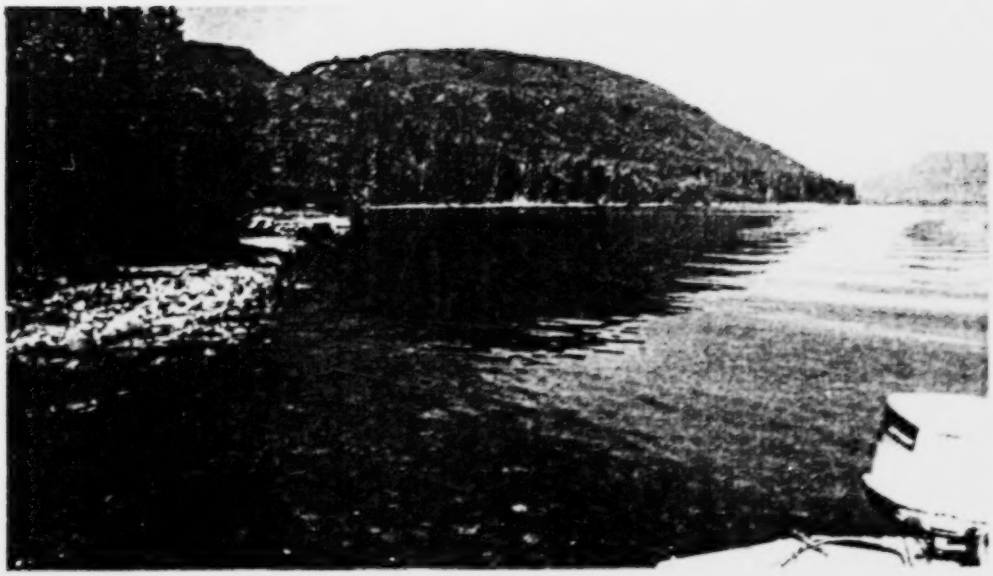


Plate 9.
Cobble beach and extensive shallows at Gwillim Lake stations S1 (above) and S2 (below) in the east end of the lake offer little cover. Further west the lake shore becomes steeper although shallow areas and weeds were found at both ends of the lake.

receives during much of the year. However, the steep slopes around Gwillim Lake also protect it from the high winds which blow across Moberly Lake.

3.4 PHYSICAL LIMNOLOGY

When first sampled in October, 1989, both lakes had deep epilimnions typical of fall cooling (Figures 11 and 12). However, oxygen within the upper mixed layer remained well below saturation. Moberly Lake began to freeze on December 1, 1989 when ice covered approximately one kilometre at both ends of the lake. The Moberly Lake thermograph malfunctioned during the winter and no data were obtained. Gwillim Lake did not begin to freeze until December 10. It went through several freeze/thaw cycles before finally freezing on December 18. The thermograph tethered at a depth of 4.5 m in Gwillim lake recorded a temperature of 8.6 when installed on October 18, 1989. Temperature declined steadily until mid December and then remained steady in the range 1.8 - 2.5°C until early March (Figure 13).

In Gwillim Lake, temperature began to warm in early March. Ice cover left the west end in early April and both the daily temperature range and the rate of wanning began to increase. This effect was probably somewhat greater than that shown in Figure 13 as the bottom tethered thermograph which had been set at 4.5 m depth in October, became further below the surface as water levels rose in the spring freshet. It was stationed at 5.2 - 6 m during peak water levels in May and June.

Ice left the outlet of Moberly Lake on March 22, 1990 and breakup progressed back across the lake over the next two weeks. This was slightly earlier than Gwillim Lake where break-up began April 1 and was essentially complete by April 26. By mid June, when profiles in the lakes were resampled, there was evidence of both spring mixing and the onset of summer stratification (Figures 11 - 12,14 - 15). In the deep layer, oxygen had increased to 10.4 $mg \cdot L^{-1}$ (89% saturation) in both lakes (Table. 4).

Table 4
Oxygen and temperature at maximum depth
Moberly and Gwillim Lakes, 1989/90

Station		October			June			August		
		Temp. °C	Oxygen $mg \cdot L^{-1}$	%	Temp. °C	Oxygen $mg \cdot L^{-1}$	%	Temp ^{0}C	Oxygen $mg \cdot L^{-1}$	%
Moberly	P1	7.6	7.9	71	5.0	10.4	89	5.5	8.6	73
Gwillim	P1	8.3	8.9	83	4.8	10.4	89	5.9	9.5	83

Figure 11.
Temperature and oxygen observations at
Moberly Lake station P1, 1989-90.

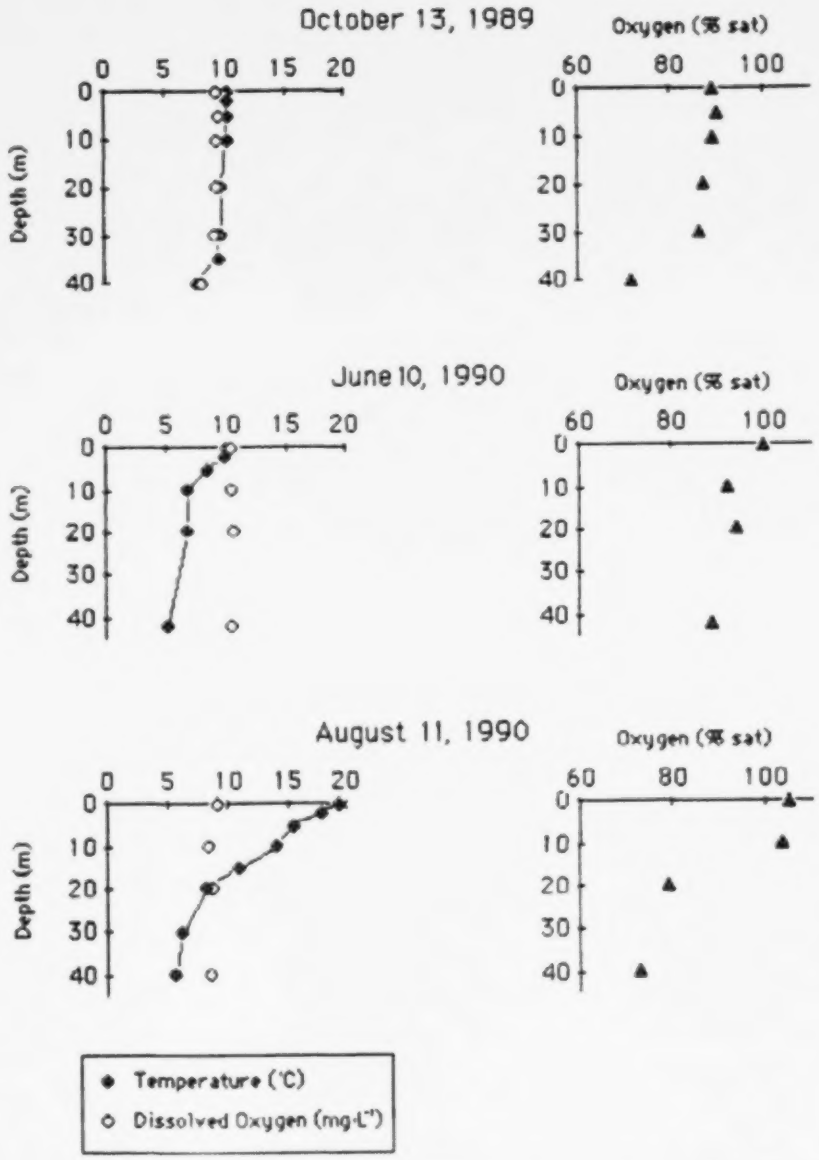


Figure 12.
Temperature and oxygen observations at Gwillim Lake station P1, 1989-90.

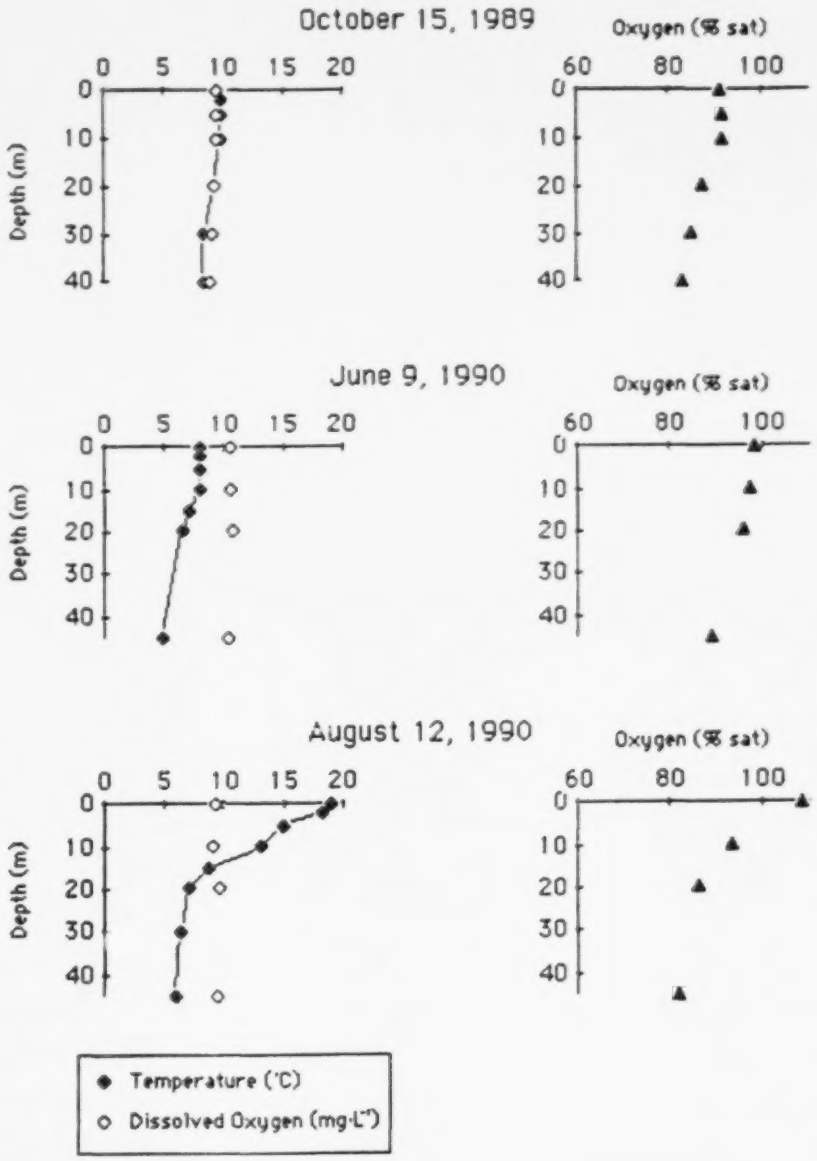


Figure 13.
Temperatures at 5m depth in Gwillim Lake, 1989-90.

Daily maximum, mean and minimum from hourly observations

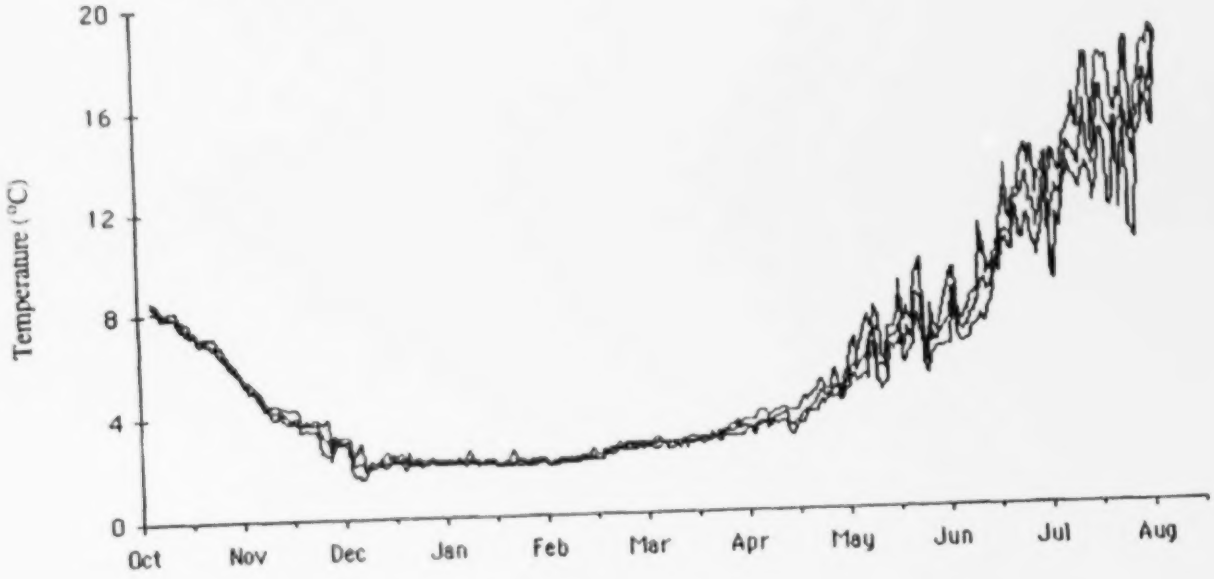


Figure 14.
Temperature and oxygen observations at
Moberly Lake station P2, 1989-90.

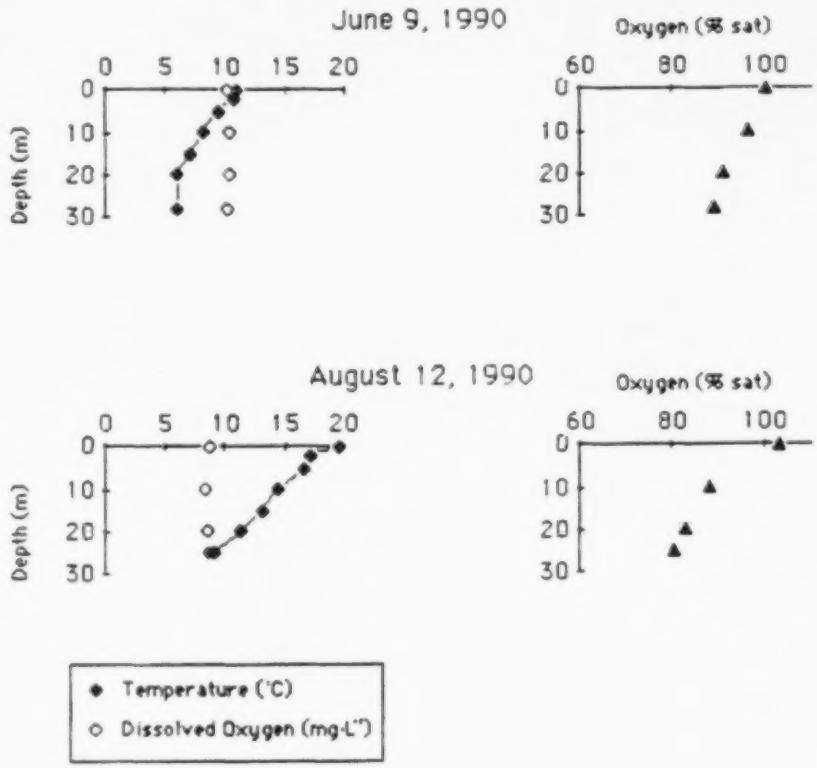
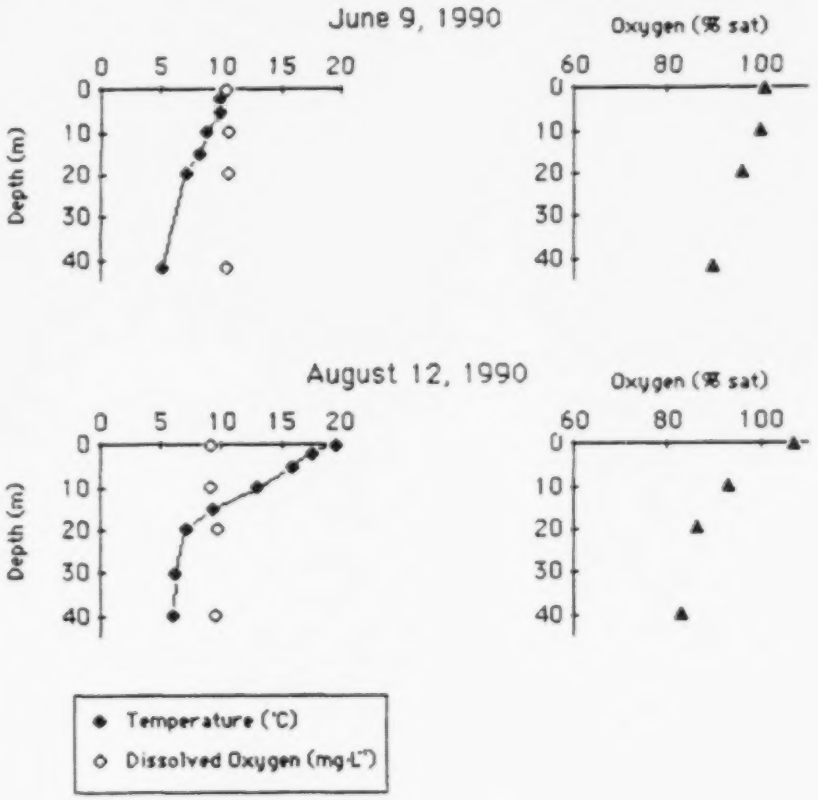


Figure 15.
Temperature and oxygen observations at
Gwillim Lake station P2, 1989-90



The Gwillim Lake thermograph was re-tethered at a depth of 5.2 m following servicing in early June. Temperatures at this depth continued to rise with 10°C being the daily maximum on June 4 and the daily mean on June 28. The maximum temperature at this station (18°C) was recorded on August 15, shortly before the instrument was removed. By this time both lakes had a well developed epilimnion with dissolved oxygen in the surface water ranging from 103 - 105% in Moberly Lake and 105 - 108% in Gwillim Lake. In August the mixed layer appeared to extend to about 30 m in Moberly Lake but to only 20 m in Gwillim Lake. Bottom waters of both lakes had warmed by about 1°C but the oxygen loss between June and August readings in Moberly Lake was much greater than in Gwillim Lake (Table 4).

Continuous temperature records were not available for Moberly Lake as the thermograph failed during the winter and was lost during the summer. However, water temperature profiles at mid lake stations (Figure 16) suggests that the thermal regime was very similar to that of Gwillim Lake.

Water transparency in Gwillim Lake, as measured by Secchi disk, varied from a maximum of 5.9 m in late fall to 0.9 m during spring freshet (Table 5). The turbidity of Moberly Lake appears to be higher and determined to a large extent by the west Moberly River during spring freshet. In June, 1990 a distinct plume could be seen spreading out from the river mouth. Secchi depths at that time were 1.5 m at the west end of the lake and 1.9 m near the east end. However maximum annual turbidity (minimum Secchi depth) may lag behind the peak freshet of the Moberly River in mid June. Whately and Nielsen (1968) reported a Secchi depth of 0.6 m on July 5, 1968: far shallower than any observed in June and August, 1990. By August, 1990, the Secchi depth had increased substantially at all stations (Table 5).

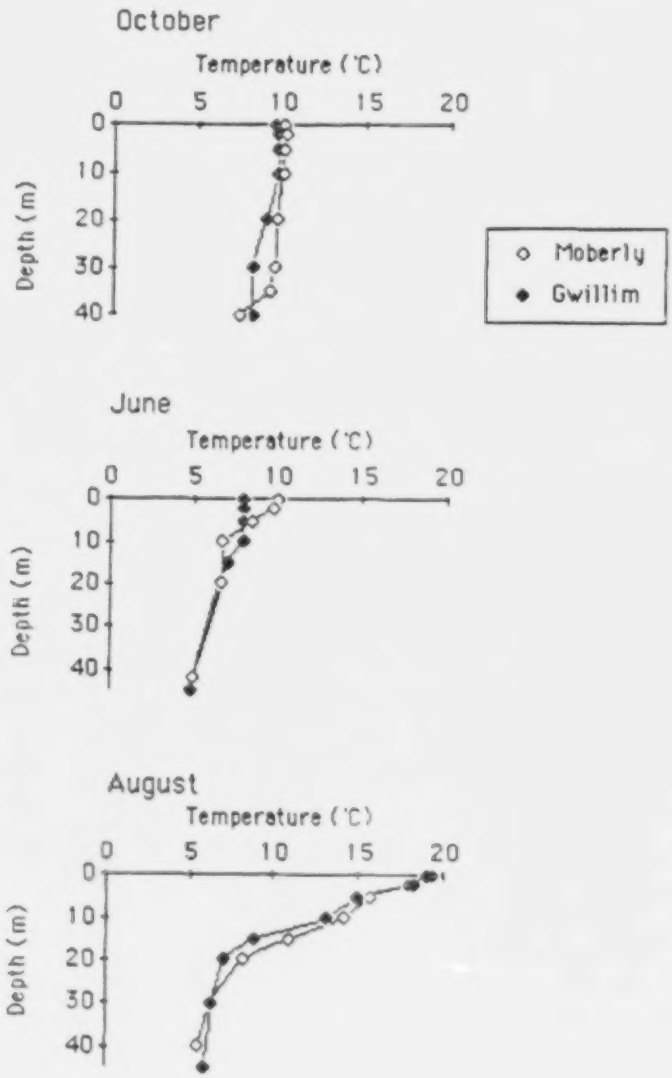
Table 5
Secchi depth (m) at mid lake stations, 1989-90

	Moberly Lake		Gwillim Lake	
Date	P1	P2	P1	P2
Oct 18			5.9	
Nov. 8	5.0			
June 9 -10	1.5	1.9	0.9	1.1
August 11 - 12	2.8	3.2	3.8	3.8

3.5 WATER CHEMISTRY AND LAKE PRODUCTIVITY

Water quality at mid-basin stations in Gwillim and Moberly Lakes is summarized in Table 6. In general, nutrient levels were oligotrophic to mesotrophic. Most

Figure 16.
Comparison of temperature profiles at staiton P1 in Moberly and Gwillim Lakes, 1989-90.



parameters sampled were within acceptable limits for fish culture (CCREM 1987, Sigma 1983) although aluminum and iron were high in some of the Moberly Lake samples.

Table 6
Summary of water chemistry analysis
Moberly and Gwillim Lakes, August 11 & 12, 1990

	Moberly				Gwillim			
Parameters*	P1 Sfc	P1 Bttm	P2 Sfc	P2 Bttm	P1 Sfc	P1 Bttm	P2 Sfc	P2 Bttm
Alkalinity (Total 4.5)	87.3	88.3	87.4	86.0	123.0	122.0	124.0	122.0
Ammonia	0.007	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	0.005
Conduct, (umhos/cm)	170	176	175	170	230	235	235	235
Dissolved oxygen	9.0	8.6	8.8	8.7	9.2	9.4	9.0	9.5
Dissolved 0_2 (%)	105	73.1	10	80.8	108	82.2	107	83
Hardness	87.4	91.3	89	90.5	119	127	127	124
Nitrite	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrate	<0.01	0.10	<0.02	0.05	0.04	0.08	0.06	0.08
pH (field)	8.3	7.7	8.2	7.7	8.4	7.8	8.4	7.8
pH (lab)	8.3	8.2	8.3	8.3	8.5	8.4	8.5	8.4
Residue (filterable)	118	120	120	116	162	162	152	156
Residue (non-filterable)	1	2	1	9	2	3	2	3
Temperature (C)	19.3	5.5	19.6	9.0	19.0	5.9	19.5	5.9
Aluminium	<0.1	0.14	<0.10	0.16	<0.1	0.1	<0.1	<0.1
Barium	0.12	0.12	0.12	0.14	0.13	0.15	0.14	0.15
Boron	<0.01	<0.01	<0.01	<0.01	<0.01	<).01	<0.01	<0.01
Calcium	24.0	25.1	24.5	24.8	33.8	36.3	36.2	35.4
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	0.1	0.14	0.1	0.5	0.04	0.13	0.04	0.1
Magnesium	6.66	6.94	6.87	6.94	8.39	8.85	8.90	8.62
Manganese	<0.01	<0.01	<0.01	0.08	<0.01	<0.01	<0.01	<0.01
Molybdenum	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Total)	0.24	0.26	0.20	0.26	0.21	0.23	0.22	0.24
Nickle	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorous (Total)	0.009	0.012	0.007	0.017	0.007	0.019	0.007	0.017
Lead	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	<0.01	0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01
Zinc	0.02	0.04	0.0	0.03	0.03	0.05	0.04	0.03

*Dissolved $mg \cdot L^{-1}$ unless noted.

Aluminum concentrations in the two bottom water samples were 0.14 - 0.15 $mg \cdot L^{-1}$ in Moberly Lake and 0.1 $mg \cdot L^{-1}$ in one of the Gwillim samples. These values exceed CCREM (1987) recommendations (<0.1 $mg \cdot L^{-1}$) for waters with pH greater than 6.5.

Iron concentration (0.5 $mg \cdot L^{-1}$) was also high in one of the Moberly Lake samples. This exceeds the 0.3 $mg \cdot L^{-1}$ recommended by CCERM (1987) and Sigma (1983) and should be monitored. However it is not high enough to limit sportfish populations.

Slightly higher filterable residue levels in bottom samples (Table 6) suggests that turbidity is likely higher in deeper waters.

Table 7 summarizes pH values observed in the study lakes. Both systems were slightly basic. Moberly Lake samples ranged form pH 7.8 - 8.4 which was slightly higher than the 7.7 - 8.3 observed in Gwillim Lake which is has much harder water (Table 7). There was a 0.3 pH difference between June surface and bottom samples from Gwillim Lake which suggests that spring overturn was not as complete as it had been on Moberly Lake even though summer stratification had developed much further on Moberly Lake by the time the samples were taken.

Table 7
pH at stations in Moberly and Gwillim Lakes, 1989-90

Dale	Moberly Lake				Gwillim Lake			
	P1		P2		P1		P2	
	Sfc	Btm	Sfc	Btm	Sfc	Btm	Sfc	Btm
Oct 15	8.1	8.0			8.1	7.9		
June 9/10	8.2	8.2	8.2	8.0	8.0	7.7	8.0	7.8
Aug 11/12	8.4	7.8	8.4	7.9	8.3	7.7	8.2	7.7

In terms of nutrients, the lakes were marginally oligotrophic. Total phosphorous values (0.007 - 0.017 mag·L^{-1} in Moberly, 0.007 - 0.019 mg·L^{-1} in Gwillim) straddle the 0.009 mg·L^{-1} demarcation suggested by Vollenweider (1968). Total nitrogen (0.20 - 0.26 in Moberly, 0.21 - 0.24 in Gwillim Lake) were slightly below the mesotrophic minimum 0.30 mg·L^{-1}.

Total dissolved solids (filterable residues) in Moberly Lake ranged from 116 - 120 mg·L^{-1} with a mean of 119 mg·L^{-1} (Table 6) which is slightly higher than the 111 mg·L^{-1} observed by Whately and Nielson in July 1968. Dissolved solids in Gwillim Lake were averaged 158 mg·L^{-1} in the four samples. This was also higher than the 136 mg·L^{-1} reported by Burns and Stratis (1976). MEI values (see section 2.7) for the two lakes, calculated from mean total dissolved solids (Table 6) and mean depth (Table 1), were 6.53 and 5.11 for Moberly and Gwillim Lakes respectively. Ryder (1965) and Leach et al. (1977) suggest that lakes with MEI of 6 - 7.2 are mesotrophic while those <6 are oligotrophic. On this basis, Moberly Lake is mildly mesotrophic while Gwillim Lake is oligotrophic .

3.6 SHORELINE CONDITIONS

Water levels in Gwillim Lake fell only 6 cm between October and freeze-up. During the winter, ice movements displaced the gauge numerous times. However,

once the ice was clear in the spring, levels and temperatures rose rapidly from 1.25 m on April 5, to 1.67 m on May 24 (Figure 6). The lake surface dropped to 1.39 m the following week but rose to the maximum for the year on June 14, reflecting the unusually high rainfall and spring runoff.

Moberly Lake declined much further during the early winter, dropping from 1.1 m on November 15 to 0.9 m by January 3. The system then remained in the range 0.6 - 0.9 m until late March. Following break-up, Moberly Lake rose through April and remained high through May and early June (Figure 6). Maximum heights are unknown as the gauge was overtopped through much of this period, again reflecting the unusually runoff experienced in 1990.

Dissolved oxygen levels remained high throughout the study (Table 8). Some supersaturation was evident in the summer, especially in the August samples from Moberly Lake, which were taken during the afternoon.

Table 8
Oxygen and temperature at shoreline stations
Moberly and Gwillim Lakes, 1989/90.

Station	October			June			August		
	Temp.	Oxygen		Temp.	Oxygen		Temp.	Oxygen	
	°C	$mg \cdot L^{-1}$	%	°C	$mg \cdot L^{-1}$	%	°C	$mg \cdot L^{-1}$	%
Moberly									
S1	8.5	9.9	91	12.0	10.5	106	27.0	10.4	140
S2	8.5	9.6	89	10.0	9.7	94	27.0	9.9	133
S3	8.5	10.5	97	10.7	10.2	100	25.5	8.6	113
S4	7.5	10.2	92	12.0	10.5	106	25.5	9.0	118
S5	8.5	10.2	94	11.0	10.0	99	24.0	8.8	112
S6							27.0	10.1	136
S7							27.0	10.6	143
Gwillim									
S1	9.5	9.5	91	10.0	9.8	96	19.0	9.4	111
S2	9.5	9.4	90	10.5	10.0	99	18.5	9.1	106
S3	9.0	9.5	90	7.9	10.5	97	19.0	9.2	108
S4	8.5	9.6	90	8.2	10.4	97	19.5	9.3	111

Table 9 shows that pH along the shoreline of the study lakes was lowest in June but remained in the range 7.9 - 8.0 on Moberly Lake and slightly higher in Gwillim Lake. The highest values were recorded in August and are probably related to

active photosynthesis in these areas. pH 8.6 and 8.8 were recorded from the shallow, weedy stations at both ends of Moberly Lake.

Table 9
pH at shoreline stations in Moberly and Gwillim Lakes, 1989/90

Station		October	June	August
Moberly	S1	8.1	7.9	8.4
	S2	8.0	7.9	8.4
	S3	8.4	8.0	8.3
	S4	8.0	8.0	8.3
	S5	8.2	7.9	8.3
	S6			8.6
	S7			8.8
Gwillim	S1	8.1	8.1	8.3
	S2	8.1	8.2	8.4
	S3	8.1	8.2	8.3
	S4	8.0	8.2	8.2

3.7 FISH

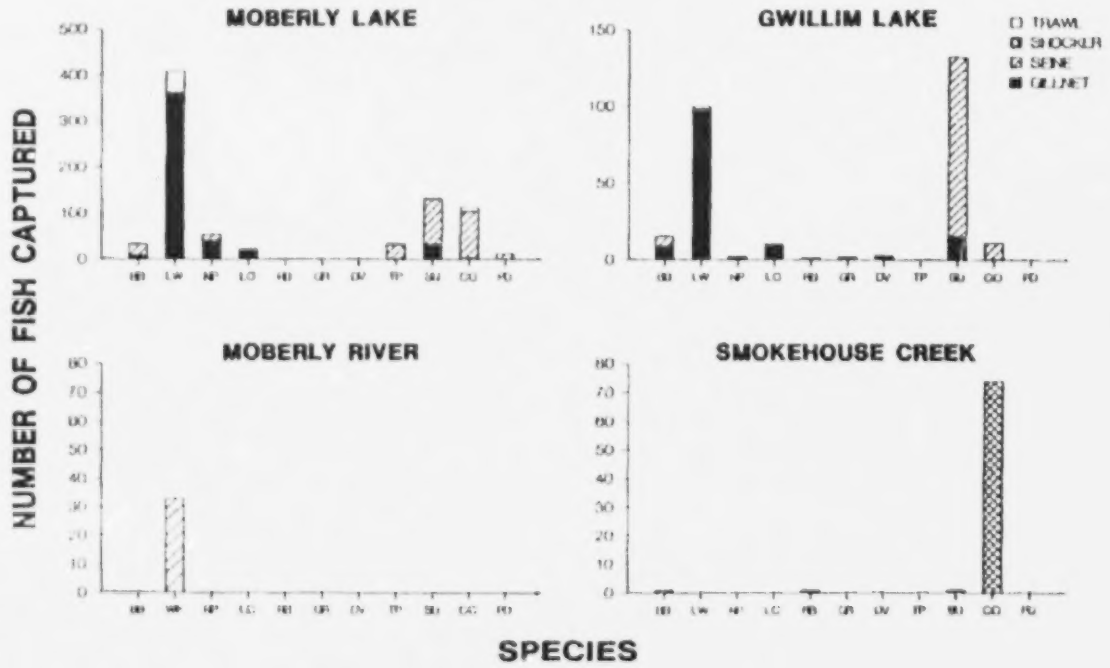
A wide array of fish species were sampled in both lakes. A summary of species captured are listed in Table 10 and relative species catch by sampling method are presented in Figure 17.

Table 10
Summary of fish species observed, 1990

Species		Moberly	Gwillim
Arctic Grayling	*Thymallus arcticus*		x
Bull trout	*Salvelinus malma*		x
Burbot	*Lota lota*	x	x
Cottids	*Cottus* sp.	x	x
Lake char	*Salvelinus namaycush*	x	x
Lake whitefish	*Coregonus clupeaformis*	x	x
Largescale sucker	*Catostomus macrocheilus*	x	x
Longnose sucker	*Catostomus catostomus*	x	x
Mountain whitefish	*Prosopium williamsoni*	?	
Northern pike	*Esox lucius*	x	x
Pearl dace	*Semotilus margarita*	x	
Rainbow trout	*Onchoryhnchus mykiss*		x
Slimy sculpin	*Cottus cognatus*	x	x
Trout perch	*Percopsis omiscomaycus*	x	
White sucker	*Catostomus commersoni*	x	x

Figure 17.
Species compositions for Moberly Lake, Moberly River, Gwillim Lake, and Smokehouse Creek based on sampling by trawl, electroshocker, beach seine and gillnet, 1990.

BB = burbot, WF = whitefish spp., LW = lake whitefish, NP = northern pike, LC = Lake char, RB = rainbow trout, GR = Arctic Grayling, DV = Bull trout, TP = Trout Perch, SU = sucker spp., CC = Sculpin spp, PD = Northern Pearl Dace.



Catch compositions were similar, but not identical to those previously reported from Moberly Lake in the late 1950's and 1960's by MOE. Redside shiners *(Richardsoni balteatus)* and lake chub *(Couesius plumbeus)(*Balkwill 1959) and northern squawfish *(Ptycheilus* 0reg0nmse)(Whately and Nielsen 1968) were not observed in the 1990 catches from Moberly Lake. Some confusion in whitefish species identification may have occurred, or alternatively, mountain whitefish may have declined in abundance: mountain whitefish but no lake whitefish were reported on occasion by MOE, whereas no mountain whitefish were positively identified in the 1990 catches from Moberly Lake. However 33 whitefish fry sampled from the Moberly River were not identified to the species level.

Species catches from Gwillim Lake were similar to those reported in 1976 by Burns and Stratis (1976) with two exceptions. A small number of mountain whitefish were identified in 1976, but none identified in the 1990 catches. Two rainbow trout were sampled in 1990 compared to zero catch in 1976.

Comparisons of catch per unit effort (CPUE) could not be made between 1960-70 and 1990 to accurately assess changes in (relative) abundance for most forage and sport fish species because the earlier MOE catch records did not consistently report each catch with the associated sampling information (e.g. gillnet mesh sizes, depth and length; soak time, etc.), or where sufficient information was provided, sampling gear differed significantly from that used in 1990.

Similarly, age and size distributions could not be compared because the 1951 catch report did not describe the sampling gear used to collect lake char that were measured and aged (i.e., gillnets are highly size-selective; Hamley 1975). We were unable to locate any other previously aged samples.

Acoustic surveys completed in 1990 suggest that both Moberly and Gwillim Lakes have sparse populations of pelagic fish. The surveys were restricted to transects in those areas >7.62 m in depth and tend to underestimate fish in the 0 - 6 m depths. A side scanning sonar would have been more appropriate for sampling the shallower and littoral portions of the lake (R. Johnson, Canadian Biosonics, pers, comm.). Information from shallower areas would have been a more useful adjunct to the walleye assessment Accepting these limits, it was reported that mean density of pelagic fish in Moberly Lake was 1.3 fish·1000 m^{-3} while in Gwillim Lake there were only 0.083 fish·1000 m^{-3} (Appendix 6).

Pelagic fish in Moberly Lake were denser along the north shore and towards the western end of the lake. Although the dual beam system used tends to underestimate targets <6 m deep, the majority of the fish appeared to be at depths

of 6 to 24 m. Echoes returned by the fish ranged in strength from -68 to -36dB with a mean strength of -50.8dB.

Fish in Gwillim Lake were generally deeper (12 - 36 m in depth) than those in Moberly lake although skies were clear on both sampling nights. As in Moberly Lake, fish densities were higher towards the west end of the lake

3.7.1 Forage Fish

Although all species of suitable size will likely be eaten by walleye (i.e., fish <120 mm), most of the non-game species sampled plus the lake whitefish are typical forage of walleye (Scott and Crossman 1973).

Troutperch, sucker spp., northern pearl dace, sculpin spp., lake whitefish, and burbot were the most abundant species of suitable size captured in Moberly Lake (Figures 18 and 19). Lake whitefish, sucker spp., burbot, and sculpin spp. were the primary forage species captured in Gwillim Lake, although their (relative) abundances in the optimum size range were significantly lower than catches from Moberly Lake (Table 11, Figures 20 and 21).

Estimates of potential forage fish densities (<120 mm) by habitat type and sampling method for Moberly and Gwillim lake systems are presented in Table 11. A large fraction of the potential forage in both lakes was comprised of juvenile lake whitefish and sucker spp.

Table 11
Summary of forage (<12 cm) fish catches
in the Moberly and Gwillim systems, 1990

Month	System	Habitat type	Method	Repli-cates	Mean forage* ($mg \cdot m^{-3}$)
June	Moberly L.	0-10m	trawl	3	1.5
June	Gwillim L.	0-10m	trawl	6	0.0
August	Moberly R.	mud-glide	seine	1	19
August	Moberly L	rock/weed	seine	3	25
August	Moberly L.	gravel	seine	3	39
August	Moberly L	mud/weed	seine	2	51
August	Moberly L.	0-10m	trawl	6	1.2
August	Gwillim L.	0-10m	trawl	6	0.2
August	Gwillim L.	mud/weed	seine	1	250
August	Gwillim L.	gravel	seine	1	14
August	Smokehouse Ck.	gravel	shocker	2	**

* Calculated from Appendix IV Catch summary and Appendix V Fish Analysis.

** Length and weight data were not available for Smokehouse sculpins. If for model purposes they were assumed to be similar to the mean size of the Gwillim Lake sculpins, density would be 1,600 $mg \cdot m^{-3}$ which is improbable.

Figure 18.
Length frequency distributions of the four non-game species sampled by trawl, beach seine and gillnet, Moberly lake, 1990.

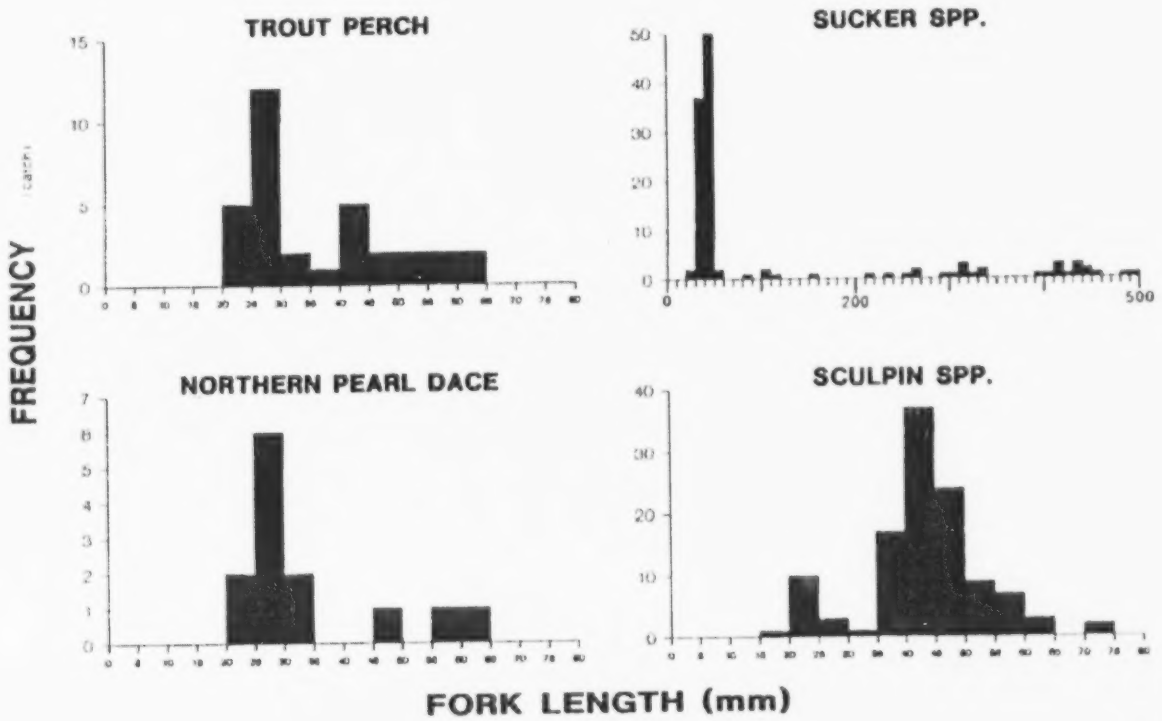


Figure 19.
Length frequency distributions of the four dominant sportfish species sampled by trawl, beach seine and gillnet, Moberly Lake, 1990.

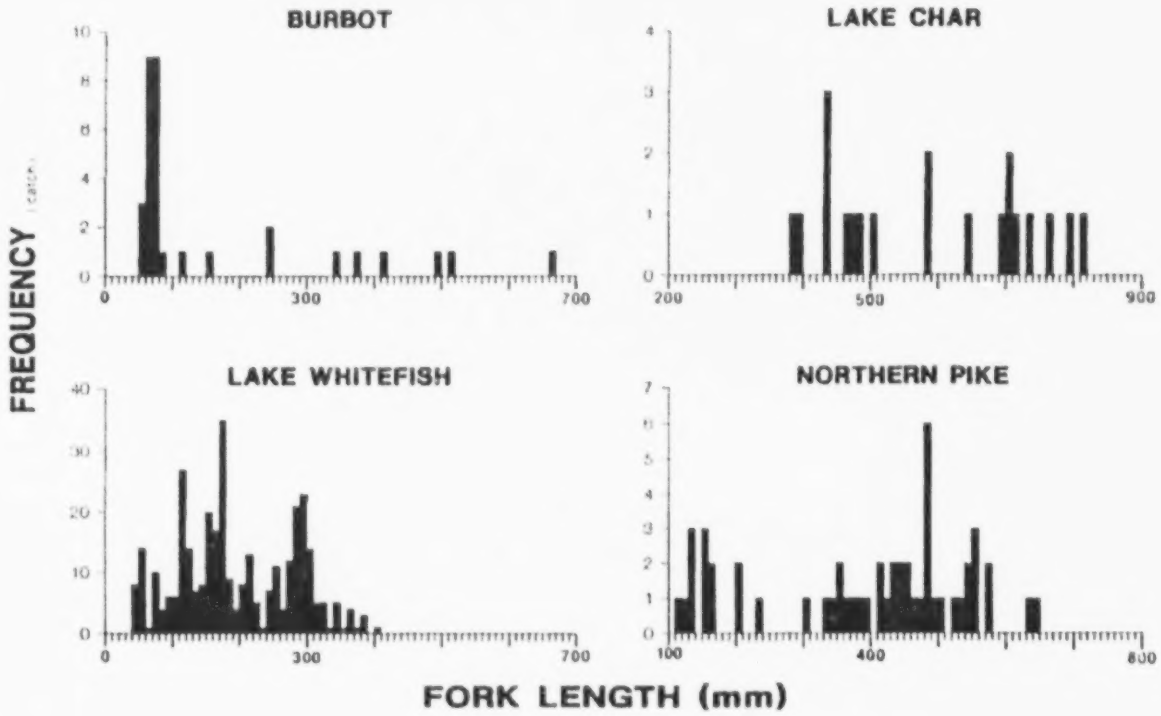


Figure 20.
Length frequency distributions of the two major non-game species sampled by trawl, beach seine and gillnet, Gwillim Lake, 1990.

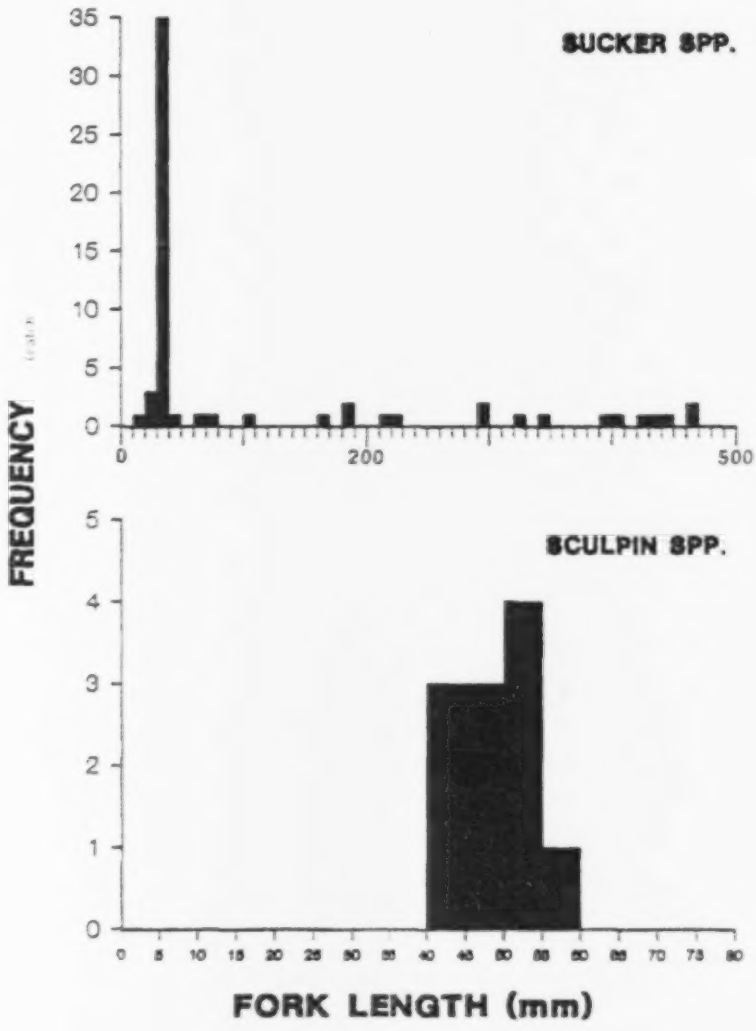
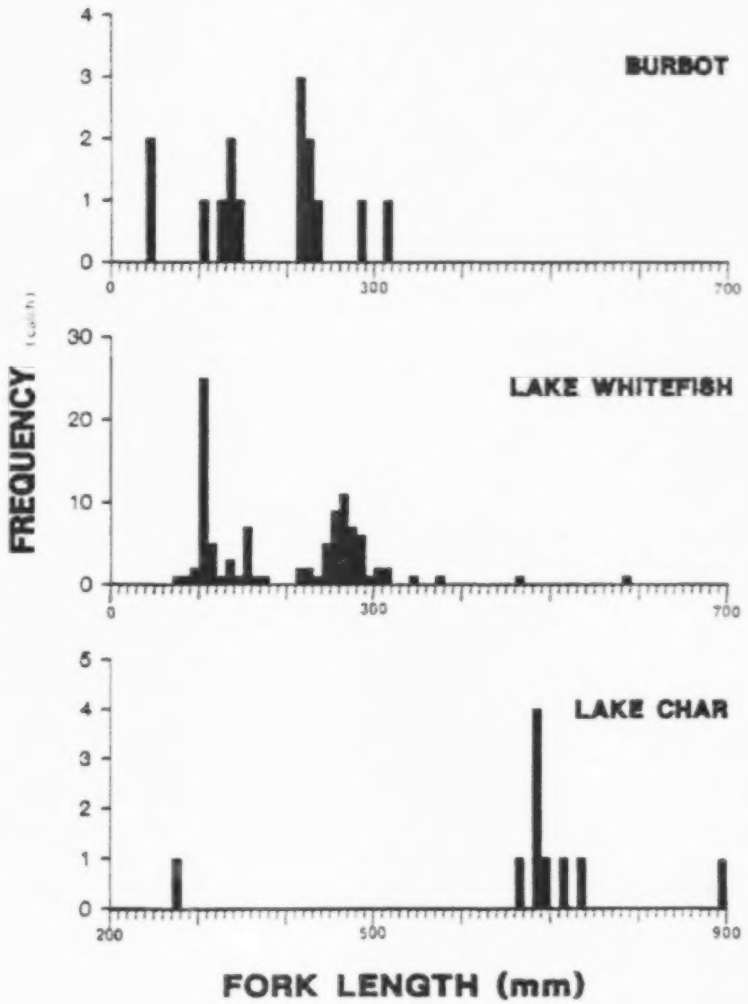


Figure 21.
Length frequency distributions of the three dominant sportfish species sampled by trawl, beach seine and gillnet, Gwillim Lake, 1990.



Catch densities were consistently higher in the littoral zone (sampled by night seining) than from the 0-10 m limnetic zone (sampled by night trawls) at both lakes (Table 11). Forage density estimates for the limnetic zone were substantially higher in Moberly Lake, although zero catches were common during the 10 minute trawls at both lakes. Beach seine catches from both lakes were highest in the mud and weed areas of the littoral zone which contained particularly large numbers of juvenile suckers.

3.7.2 Indigenous Sport Fish

Four and seven sport fish species were captured in Moberly and Gwillim lakes, respectively (Figure 17; Tables 12 and 13). In order of abundance of catchable sized fish, these included lake whitefish, northern pike, lake char, and burbot from Moberly Lake (Table 12) and lake whitefish, lake char, burbot, bull trout, Arctic grayling, rainbow trout, and northern pike from Gwillim Lake (Table 13).

The relatively large number of lake whitefish captured ranged from 60 mm to 400 mm fork length in Moberly Lake (Figure 19) and 70 mm to 600 ram in Gwillim Lake (Figure 21) with the majority in the 200 ram to 300 ram size range in both lakes. Ages for a sub-sample ranged from 0+ to 9+ from Moberly Lake catches and 1+ to 13+ from Gwillim Lake catches (Figure 22; Tables 12 and 13).

A total of 53 northern pike captured from Moberly Lake ranged from 130 mm to 864 mm in fork length and 0+ to a maximum of 10+ in age (Table 12; Figure 22). The average pike captured was in its fifth or sixth year of life and 400-600 mm in fork length. Only two northern pike were captured in Gwillim Lake, one of which was estimated at age 6+ (Table 13).

Lake char were captured in relatively low numbers in both Moberly (n = 20) and Gwillim (n = 10) lakes (Tables 12 and 13). The Moberly Lake catch ranged from 385 mm to 810 ram in length (Figure 19) and 4+ through 9+ in age (Figure 22). The size and age distributions of the smaller catch from Gwillim Lake were slightly larger (Figure 21) and older (Figure 22).

Although burbot may not have been highly vulnerable to the sampling methods used, Moberly Lake appears to contain both a larger total population and more fish of size attractive to fishermen (Figures 19 and 20).

At fork lengths under 300 mm, the three Arctic grayling, three bull trout and two rainbow trout captured in Gwillim Lake were only approaching typical size-at-recruitment to sport fisheries.

Table 12.
Lengths and weights of sport fish at time of capture in Moberly Lake June - September, 1990.

		Length at Capture (mm)			Weight at Capture (g)		
Age1	N	Mean	Range	SE	Mean	Range	SE
BURBOT							
na	32	158	56 - 666	29.3	155	1.3 - 2,200	74.7
LAKE CHAR							
na	6	469	385 - 580	28.1	1,329	450 - 2,600	334
4+	1	393			725		
5+	3	453	430 - 470	12.0	1,075	900 - 1,200	90.1
6+	1	580			2,400		
7+	3	680	641 - 704	19.8	4,200	2,800 - 5,500	781
8+	4	731	707 - 761	12.0	5,850	4,500 - 7,800	796
9+	2	801	791 - 810	9.5	8.525	8,000 - 9,050	525
LAKE WHITEFISH							
na	164	182	45 - 378	6.4	121.6	0.6 - 750	11.2
0+	2	60	55 - 64	4.5	1.9	1.8 - 2.1	0.2
1+	41	102	52 - 155	4.1	14.2	1.2 - 54.3	1.9
2+	49	168	121 - 216	3.4	58.2	15.0 - 126.8	4.0
3+	9	224	193 - 254	7.8	135.5	33.4 - 235	21.3
4+	9	260	223 - 306	7.5	238	190 - 345	16.4
5+	22	283	249 - 313	3.1	298	215 - 365	8.3
6+	20	295	279 - 322	2.6	326	275 - 445	10.2
7+	11	337	291 - 387	8.7	481	340 - 650	28.3
8+	1	345			525		
9+	7	358	302 - 402	13.7	655	355 - 975	84.3
NORTHERN PIKE							
na	5	328	130 - 495	72.9	398.4	16.7 - 1,025	192.2
0+	10	152	118 - 208	8.0	25.8	11.5 - 54.7	4.0
2+	2	273	237 - 308	35.5	147.5	95.0 - 200	52.5
3+	5	401	348 - 471	25.3	466	265 - 825	110.7
4+	12	451	350 - 557	21.4	677	345 - 1.000	81.3
5+	11	484	414 - 648	22.5	838	375 - 1,775	121.0
6+	4	551	488 - 639	32.3	1,118	725 - 1,475	171.5
7+	3	540	502 - 575	21.2	1,108	825 - 1,350	153.0
10+	1	864			3,900		

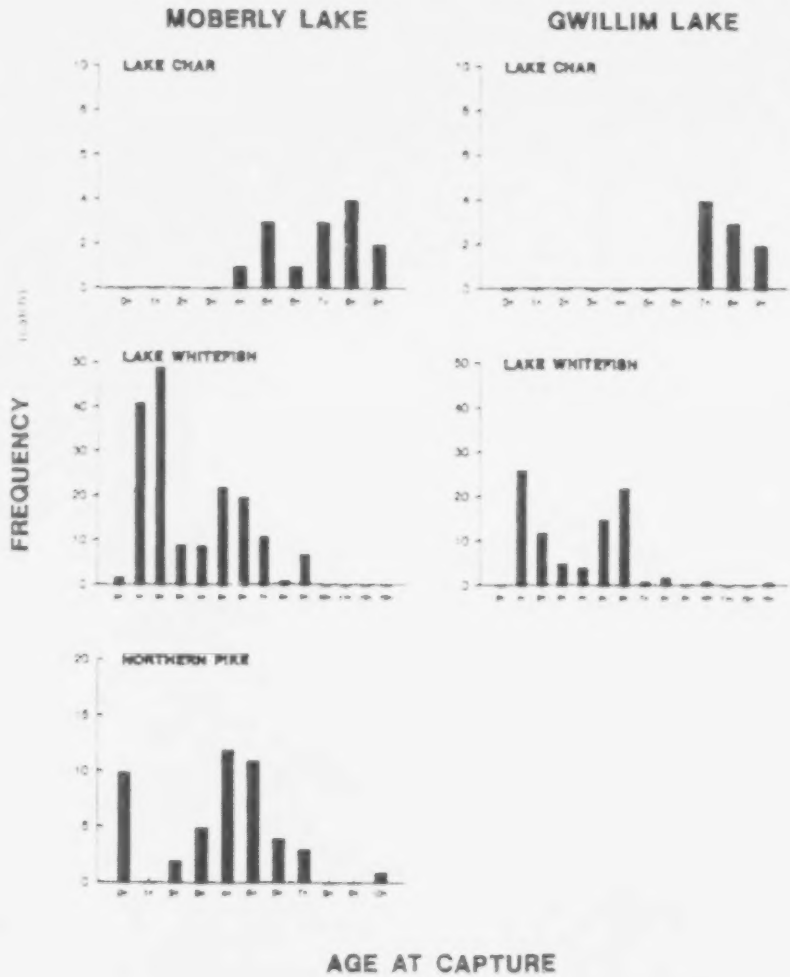
na - not aged.

Table 13.
Lengths and weights of sport fish at time of capture in Gwillim Lake, June - September, 1990.

		Length at Capture (mm)			Weight at Capture (g)		
Age	N	Mean	Range	SE	Mean	Range	SE
BURBOT							
na	15	177	41 - 310	20.9	49.3	0.6 - 175	12.7
BULL TROUT							
na	3	234	218 - 261	13.4	219.2	112.6 - 370	77.5
ARCTIC GRAYLING							
3+	2	285	276 - 294	9.0	245.0	235 - 255	10.0
LAKE CHAR							
na	1	272			195		
7+	4	681	665 - 689	5.4	4,875	4,400 - 5,500	228
8+	3	699	688 - 710	6.4	4,966	4,800 - 5,300	166
9+	2	824	732 - 916	92.0	8,275	6,300 - 10,250	1,975
LAKE WHITEFISH							
na	11	135	100 - 271	19.0	47.1	10.0 - 225.0	24.0
1+	26	104	72 - 132	2.0	11.3	4.1 - 20.1	0.5
2+	12	149	126 - 164	3.2	33.9	20.0 - 45.3	2.4
3+	5	229	216 - 249	5.7	133.4	105.0 - 180	13.6
4+	4	217	170 - 243	16.9	132.5	49.8 - 190	30.1
5+	15	265	246 - 304	3.8	211	163 - 290	9.1
6+	22	276	249 - 314	3.5	241	185 - 380	9.8
7+	1	345			440		
8+	2	343	312 - 373	30.5	560	395 - 725	165
10+	1	464			1,125		
13+	1	580			1,337		
NORTHERN PIKE							
na	1	598			2,700		
6+	1	680			1,525		
RAINBOW TROUT							
2+	2	163	157 - 169		45.4	45.4 - 45.4	

na - not aged.

Figure 22.
Age frequency distributions of five major sportfish species sampled by trawl, beach seine, and gillnet in Moberly and Gwillim Lakes, 1990.



3.8 WALLEYE HABITAT SUITABILITY

3.8.1 Moberly Lake System

Measured and calculated values for each variable, and assigned Suitability Indices, Life Requisite Indices and the culminating Habitat Suitability Index are presented in Table 14.

Favorable Suitability Indices (a rating of good to excellent) were obtained for Secchi transparency (V_1), cover (V_3), pH (V_4), various dissolved oxygen parameters (V_5, V_6, & V_7), and trophic status (V_{14}). Water level (V_{13}) was assumed to be similar to that of the Moberly River as no data was obtained for Smokehouse Creek. Prey abundance (V2) and spawning habitat (V_{12}) measurements were rated fair and, with the exception of spring spawning (V_{10}), all remaining temperature-related variables (V_8, V_9, & V_{11}) were rated poor or unsuitable.

As a result of the low spring and summer temperatures, both "water quality" (LRI = 0.10) and "reproduction" (LRI = 0.04) Life Requisite Indices were classified as unsuitable for walleye. Food, cover and trophic status received good to excellent ratings (Table 14). Defined as the minimum value among the five Life Requisites, the walleye HSI for Moberly Lake was estimated at 0.04 (unsuitable).

With the exception of spawning habitat (V_{12}), Suitability Indices for the Moberly River were similar to those obtained for Moberly Lake (Table 14). No suitable spawning habitat was observed in the 10 km reach immediately upstream of Moberly Lake; however, spawning habitat could be available to potential lake migrants further upstream. HSI was estimated at 0 (unsuitable).

Table 14.
Habitat variables, field measurement values and suitablity index estimates for walleye Moberly Lake and Upper Moberly River, 1989-90.

Variable	Unit of measure	Measured or Calculated Value		Suitability Index (SI)[c]		Life Requisite Index[c]		Habitat Suitability Index (HSI)	
		Lake	River	Lake	River	Lake	River	Lake	River
FOOD						0.60	0.62		
V1-Secchi Transparency	m	3.0	1.5	1.00	1.00				
V2-Relative Prey Abundance	mg m^{-3}	1.4[a]	19.0	0.20	0.23				
COVER						0.94	0.88		
V1-Secchi Transparency	m	3.0	1.5	1.00	1.00				
V3-Cover & DO	%	18.0[b]	10.0	0.75	0.52				
WATER QUALITY						0.10	0.02		
V4-Lowest pH During Year	pH units	7.8	7.9	1.00	1.00				
V5-Epilimnion/Pool-Run DO	mg L^{-1}	8.4	7.8	1.00	1.00				
V6-Summer-Fall DO	mg L^{-1}	8.6	7.8	1.00	1.00				
V8-Epilimnion/Pool Temp.	°C	15.0[c]	17.0	0.25	0.44				
V9-Shoreline Temperature	°C	12.0	7.0	0.10	0.02				
REPRODUCTION						0.04	0		
V7-Spawning DO	mg L^{-1}	9.7	10.1	1.00	1.00				
V10-Spawning Temperature	°C	9.5	5.3	0.55	0.04				
V11-Degree Days	n (°C)	170.0	0.5	0.04	0				
V12-Spawning Habitat	"index"	14.0	0[d]	0.35	0				
V13-Water Level	"ratio"	rising	rising	1.00	1.00				
OTHER									
V14-Lake Trophic Status	"ratio"	1.3 (mesotrophic)	n/a	1.00	n/a	1.00	n/a		
ALL VARIABLES								0.04	0

[a]Mean weighted by habitat type [limnetic(0-10m) and littoral(0-2m)].
[b]Adjusted for entire littoral zone from 1m isobath measurements.
[c]Adjusted from Gwillim Lake temperatures.
[d]Some spawning habitat may be available in the upper reaches(>10km).
[e]0.0 - 0.1 = Poor, 0.2 - 0.4 = Fair, 0.5 - 0.7 = Good, 0.8 - 1.0 = Excellent.

3.8.2 Gwillim Lake System

Similar to Moberly Lake, low values for temperature-related variables (V_8, V_9, & V_{11}) resulted in low Suitability Indices.(Table 15). Spawning habitat (V_{12}) and prey (V_2) were found to be relatively sparse and S1 for both variables was deemed poor. Favorable conditions (and indices) were obtained for the remaining nine variables.

Primarily due to the low temperature readings, the Life Requisite Indices for "water quality" and "reproduction" resulted in poor ratings. Cover and lake trophic status indices were good to excellent as was food (which includes transparency as well as prey abundance).

Defined as the minimum Life Requisite Index (HSI = 0.05), the HSI model predicted that Gwillim Lake would provide unsuitable habitat for walleye.

Values for habitat variables and associated Suitability Indices for Smokehouse Creek were similar to those obtained for Gwillim Lake (Table 15). Due to the implausibly high numbers of cottids resulting from Seber LeCren (1967), prey densities for Smokehouse Creek were based on sample estimates obtained from Moberly River. Unsuitable temperature regimes and inadequate spawning habitat yielded SI's of zero, and accordingly, a stream HSI of zero.

Table 15.
Habitat variables, field measurement values and suitablity index estimates for walleye Gwillim Lake and Smokehouse Creek, 1989-90.

Variable	Unit of measure	Measured or Calculated Value		Suitability Index (SI)		Life Requisite Index		Habitat Suitability Index (HSI)	
		Lake	River	Lake	River	Lake	River	Lake	River
FOOD						0.51	0.62		
V1-Secchi Transparency	m	3.8	3.0	0.81	1.00				
V2-Relative Prey Abundance	mg m^{-3}	0.5[a]	19.0	0.20	0.23				
COVER						0.82	0.85		
V1-Secchi Transparency	m	3.8	3.0	0.81	1.00				
V3-Cover & DO	%	12.5[c]	5.0	0.60	0.38				
WATER QUALITY				0.05	0				
V4-Lowest pH During Year	pH units	7.7	8.0	1.00	1.00				
V5-Epilimnion/Pool-Run DO	mg L^{-1}	9.0	8.9	1.00	1.00				
V6-Summer-Fall DO	mg L^{-1}	9.1	8.9	1.00	1.00				
V8-Epilimnion/Pool Temp.	°C	13.2	10.5	0.10	0				
V9-Shoreline Temperature	°C	11.4	7.7	0.05	0.01				
REPRODUCTION						0.06	0		
V7-Spawning DO	mg L^{-1}	9.8	9.9	1.00	1.00				
V10-Spawning Temperature	°C	9.0	4.0	0.40	0				
V11-Degree Days	°C	162	0.0	0.06	0				
V12-Spawning Habitat	"index"	5.0	0.0	0.13	0				
V13-Water Level	"ratio"	rising	rising[b]	1.00	1.00				
OTHER									
V14-Lake Trophic Status	"ratio"	0.9 (Oligotrophic)	n/a	0.95	n/a	0.95	n/a		
ALL VARIABLES								0.05	0

[a]Mean weighted by habitat type [limnetic(0-10m) and littoral(0-2m)].
[b]Based on Moberly River data.
[c]Adjusted for entire littoral zone from 1m isobath measurements.
[d]0.0 - 0.1 = Poor, 0.2 - 0.4 = Fair, 0.5 - 0.7 = Good, 0.8 - 1.0 = Excellent

PART IV

DISCUSSION

4.1 HABITAT INVENTORIES

4.1.1 Tributary habitats

Most of the tributaries examined are too small and too unstable to support sportfish through most of the year although some early spring spawning and rearing may be possible. However, Dokie Creek on the Moberly system and Smokehouse Creek on the Gwillim system are worthy of further study.

Moberly Lake tributaries are generally too small or unstable to support significant populations of walleye or other sportfish. In addition, fish passage is impeded by poor culverts in most of the creeks which drain the north shore. The lower Moberly River has a mud substrate which limits sportfish spawning although it may provide rearing habitats. The low water conditions observed in 1990 would limit the system capacity but these conditions seem to be unusual in this system. Dokie Creek, a Moberly River tributary, appears to provide varied habitats and should be examined more closely.

Most Gwillim tributaries, like those on Moberly Lake, are too small and unstable to support sportfish. The best stream spawning habitat appears to lie in Smokehouse Creek. This system flows all year and contains both pools and gravel substrates. Fish passage is however blocked by a highway culvert which is in poor condition.

4.1.2 Physical Characteristics

The study lakes are located in quite different settings however the limnology of the systems is surprisingly similar. Moberly Lake is set among low hills at an elevation of 690 m while Gwillim lake is approximately 100 m higher and surrounded by mountains. However, as Moberly Lake has a greater wind exposure, temperatures in the two lakes are comparable.

4.1.3 System Productivity

Productivity in both systems appears to be low although Moberly Lake appears to be slightly more productive than Gwillim Lake. In terms of nutrients, both systems were marginally oligotrophic. But other indicators including dissolved solids were much higher in Moberly Lake and the system also has a littoral zone which is proportionately much larger.

4.2 HABITAT SUITABILITY AND WALLEYE INTRODUCTION

The HSI values indicate that both Moberly and Gwillim lakes will not provide suitable habitat for walleye primarily due to insufficient thermal units. Based on temperature requirements reported by Kelso (1972), Smith and Koenst (1975) Hokanson (1977), the HSI model rated the temperature measurements we obtained in 1989/90 to be insufficient for gamete development, embryo development, and subsequent growth.

In addition to not sufficiently meeting basic metabolic necessities, slow growth due to low temperatures could also translate into lower yield to the fishery. A low harvestable surplus could result from a combination of poor growth (tissue elaboration) and, in turn, high mortality rates due to increased competition and predation (Colby et al. 1979).

However, the literature data used in building the HSI model is based predominantly on walleye populations or experimental specimens from southern Canada and the mid to northern USA (McMahon et al. 1984). Accordingly, temperature-related suitability indices used in the model may not be representative of walleye populations inhabiting lakes and rivers in northern Canada.

As part of the Peace River drainage, Moberly and Gwillim lakes are near the northern edge of the walleye's natural distribution (Scott and Crossman 1973). Although optimum conditions for the species in Canada is likely restricted to the southern parts (Hokanson 1977), based on empirical evidence, northern populations reaching into the Northwest Territories are successful with several yielding sufficient surplus production to support both sport and commercial fisheries (McPhail and Lindsey 1970).

On a regional level, Maxhamish Lake and the Peace River contain indigenous walleye populations that currently support low-use recreational fisheries. Although population size and harvestable surplus is not known, both fisheries have yielded exceptionally large walleye in the 3-5 kg range (J. Hammond, pers, comm., 1989). Walleye have been introduced in nearby Charlie Lake, where the population is self-sustaining and supports a popular, consumptive-oriented sport fishery (Michiel 1989). It is possible that the HSI temperature suitability curves may not accurately depict optimum temperature ranges for such northern populations. However, both Maxhamish and Charlie Lakes are shallow, exposed systems that warm quickly in the spring.

As reported by Farmer (1988), the USFWS has only recently initiated a program to test or validate the HSI models for underlying assumptions and the relationship

between HSI values and measures of carrying capacity at specific locations. Such tests would provide insight about a model's reliability in a specific geographic area. A validation study is currently underway for the walleye HSI model (egg and fry survival), with preliminary results expected in the near future (Jim Terrel, pers, comm.). However, this study is being conducted in the mid-western USA, and to our knowledge no validation studies have been planned for northern populations.

Since optimum values of the remaining habitat variables are less likely to vary with latitude, a temperature-excluded HSI may more accurately reflect regional habitat suitability. Such an adjustment results in an HSI of 0.35 (fair) for Moberly Lake and 0.13 (poor) for Gwillim Lake. In both cases, these HSI values reflect the Suitability Indices for (limited) lake spawning habitat

Hatchery support would reduce dependancy on lake spawning habitats. In that case the further adjusted HSI is estimated at 0.60 (good) for Moberly Lake and 0.51 (fair to good) for Gwillim Lake (Tables 12 and 13). Maintenance stocking of this type has proven effective in other areas although it may be necessary to stock fingerling sized fish in order to minimize predation losses (Laarman 1978).

With the exception of the higher reaches of the upper (west) Moberly River, it is unlikely that any streams at either lake would provide supplementary spawning areas for a lake migrant stock. Peace River walleye apparently make extensive spawning migrations (Pattendon et al. 1991) and if a similar migration behaviour developed, some spawning habitat may be available in the higher reaches of the upper Moberly River (>10 km). Several tributaries likely provide spawning habitat for some potential forage fishes. However, higher gradient, colder stream temperatures and an absence of pools undoubtedly limit walleye use of these systems.

In light of the above scenarios and based on our general observations on lake and fauna characteristics, Moberly Lake appears to be the best candidate for experimental stocking of walleye. On average, Moberly Lake's morphometry, water quality and fish species composition appears to fit into the broad range of lakes inhabited by walleye (Johnson et al. 1977; Colby et al. 1979). At 2,900 ha, Moberly Lake is ideal in size (Bennett and McArthur 1990) and well above the recommended minimum surface area of 400 ha (Colby et al. 1979).

Although forage abundance may be limited (SI = 0.20), all species sampled in Moberly Lake (Table 10) are known to be utilized by walleye (Scott and Crossman 1973). However, some of these species, northern pike, lake char and lake

whitefish in particular, are known competitors - such ecological interactions among species are not addressed by the HSI model.

Based on our general observations of lake morphometry/ productivity, native species composition, and HSI estimates, we do not believe that a walleye introduction would result in a successful sport fishery for Gwillim Lake. Although walleye may survive in Gwillim Lake at a maintenance level, it is unlikely that the population would grow to sufficient size or size-structure to support a sustainable sport fishery.

4.3 INDIGENOUS SPORT FISH

The relatively low catches obtained during the current study are consistent with recent angler reports on declining catch success and indicate that the principle sportfish populations are low in abundance in both lakes.

4.3.1 Lake Whitefish

Based on the catch statistics, lake whitefish (and possibly burbot) are the only sportfish population(s) that are currently in high abundance and exhibit stable size and age structure (cf., Table 12; Figures 19, 21 and 22). Whitefish are an important component of the native net fishery on Moberly Lake although they are popular among only a small percentage of anglers (Stone 1988). Accordingly, management of this species is best directed towards cropping larger individuals in the nets, and maximizing the species' role as forage for the more popular piscivores (e.g., lake char, northern pike and bull trout in Gwillim Lake; lake char, northern pike, and possibly walleye in Moberly Lake).

4.3.2 Lake Char

The relatively low total numbers of lake char captured and the absence of large older-aged fish in particular indicates that the populations in both lakes are in a depressed state. This current status is likely due to over-exploitation as opposed to changes in habitat or forage fish abundance -- no major changes in lake habitat are known to have occurred and the forage base appears to be sufficient to support a larger char population in each lake.

Unfortunately there appears to be little concrete evidence available on the nature of the fisheries in either lake. Cursory observations during 1990 suggest that few char are taken during the summer. However both systems support winter ice fishing which may harvest substantial numbers of char. The results of a winter 1989/90 creel survey on Moberly Lake suggest that most anglers targeted on burbot -

presumably because the expectation of catching char was so low (E. Down, MOE, pers. comm.). In addition, there is a native net fishery on Moberly Lake that targets on char among other species.

Relatively high rates of exploitation of lake char has likely taken place for some period of time on Moberly Lake. Although description of capture method was unavailable to assess size selectivity, six lake char captured in early autumn of 1957 (Lindsey et al. 1957) ranged 495 to 660 mm in length and an estimated 7 to 11 years in age; an additional 978 mm length char was captured but age could not be estimated. This size distribution is similar to those captured in 1990 although the char catch from 1957 was estimated to have a slightly older age distribution. If capture methods and ageing accuracy were similar between the two sampling periods, the small change in apparent population size and age structure indicates that the rate of exploitation has been relatively constant during the last 30 years.

Similarly, the sparse catch from Gwillim Lake in 1976 (Burns and Stratis 1976) was within the size range (384 to 752 mm) captured in 1990 (Figure 21)

4.3.3 Northern Pike

The size and age structure of the northern pike sampled from Moberly Lake in 1990 indicates that the population is relatively stable under current rates of exploitation. The gillnet catch in particular was comprised of pike in the size range attractive to the average recreational fishermen.

However, the relatively small catches obtained in both Moberly and Gwillim lakes during previous MOE surveys in the 1960-70's and during our study in 1990 indicate that the pike populations are small in both lakes. Accordingly, under current conditions the species will continue to support only a low-use sport fishery in Moberly Lake and provide incidental catch in Gwillim Lake.

4.3.4 Other Salmonids

The bull trout, Arctic grayling and rainbow trout catch from Gwillim Lake was too sparse to assess population structure. In addition to their low numbers, most fish captured regardless of species, were not of sufficient size (<300 mm fork length) to currently support a viable sport fishery.

The exceptionally low catches indicate that all three populations are at remnant levels. Further, the rainbow trout may represent only strays from stocking in Moose Lake which discharges into the lower Gwillim River (T. Down MOE, pers. comm.). Accordingly, further study should be directed towards each species with

respect to harvest regulation and to identify and assess the feasibility of various enhancement opportunities. For example, the cursory stream surveys revealed that many streams were impassible to potential spawners a short distance upstream from the lake. This is particularly true of Smokehouse Creek on the Gwillim system which was formerly used by all three species (J. Rosenau pers. comm.).

4.4 RISKS OF A WALLEYE INTRODUCTION

Introduction of a new species into an aquatic ecosystem does have associated risks which must be weighed against potential benefits. The ecological risks of introducing walleye into Moberly Lake may be limited, however, as the watershed is within the species' natural range (Magnuson 1976). In fact, an indigenous population exists a relatively short distance downstream in the Peace River. Interestingly, no walleye were sampled in the Moberly River upstream from its confluence with the Peace River during a recent survey and no physical barriers to migration were evident (Slaney, et al. 1991). Furthermore, both the forage species and potential competitive game species present in Moberly Lake are typical cohabitors with walleye (Scott and Crossman 1973; Colby et al. 1979). Regardless, a shift in sportfish species composition, abundance and possibly size-structure would likely occur. Considering the apparently limited risks associated with introducing walleye into Moberly Lake and the level of uncertainty of the HSI model predictions, the suitability of Moberly Lake to support a sustainable walleye fishery can only be determined empirically. Experimental stocking will be required to determined if walleye will establish in Moberly Lake as a self-sustaining or hatchery-supported population of sufficient size and size-structure to support a sustainable sport fishery. With the estimated limited spawning habitat, the walleye population may be controlled by regulating recruitment through a stocking program.

However, lake char and northern pike are presently the primary sport fish in Moberly Lake. Although these two species occur sympatrically with walleye throughout Canada, walleye are known to compete with both species to some extent for food and space. Furthermore, as opportunistic piscivores, walleye can also be expected to utilize juvenile char as well as northern pike.

PART V

CONCLUSIONS

Moberly and Gwillim Lakes appear to be: only moderately productive; limited in salmonid production by poor stream conditions and/or inaccessibility; and the principle sportfish populations are low in abundance. The low abundance and depressed age and size structure of lake char and northern pike in Moberly Lake and lake char, bull trout, rainbow trout and Arctic grayling in Gwillim Lake indicate that the current sportfish status is more a result of over exploitation as opposed to a decline in habitat quality (with the exception of some stream access limitations).

Consistent with MOE practise and the Fisheries Program Strategic Plan 90/95, fisheries based on wild, self-reproducing populations (eg., lake char, bull trout, Arctic grayling, rainbow trout, northern pike) are to be managed more conservatively than those which are hatchery supported. Accordingly, we suggest that species specific harvest regulations be implemented that take into account production capabilities, enhancement opportunity (habitat, hatchery supplementation) and angler preferences. Once preferred sets of regulations have been initiated, we also recommend routine re-assessment to ensure the regulations remain applicable as more complete information is obtained on both the fish populations and associated fisheries.

Lake char and bull trout in particular will require more restrictive harvest regulations if the objective is to manage the populations without hatchery support.

While the lake char have been the primary species supporting both fisheries, it is unlikely that they can be expected to support both current and future angler (and native net) use as the target species. As a slow growing and potentially long lived species, lake char are extremely vulnerable to over-fishing. If the management objective is to maintain a 'natural' size and age structure, even moderate levels of harvest in cold unproductive lakes can result in over exploitation (Ricker 1963).

Some additional non-regulatory management options to accommodate current and future angler demands are listed below. These alternatives to present fishery conditions are based on the strong preference of Peace Region anglers for salmonids (Stone 1988) and walleye conditioned by the findings of this study.

1. Manage the whitefish populations for the native net fishery and as forage species (high abundance / small size distribution in both Moberly and Gwillim lakes unless otherwise dictated by change in angler preference.

2. Considering the HSI results and the cool oligotrophic nature of Gwillim Lake it is probably better suited to a salmonid fishery. However, the currently depressed fisheries for lake char, rainbow trout, bull trout and Arctic grayling will required more specific study to assess enhancement opportunities.

   At this time we can recommend that basic stream enhancement work be conducted on Smokehouse Creek. First priority should be given to improving fish passage through the highway culvert under varying discharge conditions.

   Other possibilities may include hatchery supplementation using local (Peace drainage) lake char, bull trout, Arctic grayling, or rainbow trout, broodstock (to preserve gene pool) and the introduction of kokanee. Gwillim Lake with its extensive limnetic zone would appear to provide ideal habitat for the species. Although kokanee are likely to compete with the lake whitefish, they coexist in many B.C. Lakes including the nearby Williston Reservoir. Kokanee appear to be one of the few salmonids that provide favorable family oriented fisheries in large lakes containing coarse fish species. In fact, B.C. anglers collectively rank kokanee as their second choice in preferred species, following only rainbow trout (Stone 1988). The species may also provide additional forage for lake char and bull trout. If necessary, kokanee population could be controlled by regulating stream access.

3. As discussed in section 5.2, Moberly Lake is the best candidate for experimental stocking of walleye. This is based on both habitat suitability and the reduced risks associated with species introductions. The modified HSI results indicate that walleye will likely support a viable sport fishery although hatchery support may be required. Given the proximity of a walleye population a short distance downstream, the species is already a natural inhabitant of the watershed and could eventually colonize Moberly Lake naturally.

   We recommend that only local stocks be used as potential donors in order to preserve the Peace River's gene pool. However, as the riverine population may not be ideally suited to a lacustrine environment, alternative stocks could be obtained from Charlie or Maxhamish lakes. Both of these systems reproduce naturally and provide a harvestable surplus.

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DATA APPENDICES

APPENDIX I: Physical water sampling

OCTOBER

Date	System/Station			Depth	Temp.	pH	Dissolved Oxygen		Secchi
				m	'C		mg/L	% sat	m
13-Oct	Moberly	Lake	P1	0	10		9	89	
				2	10				
				5	10		9	90	
				10	10		9	89	
				20	10		9	88	
				30	10		9	86	
				35	9				
				40	8		8	71	
15-Oct	Gwillim	Lake	P1	0	10	8.14	10	91	
				2	10				
				5	10		10	92	
				10	10		10	92	
				20	9		9	87	
				30	8		9	85	
				40	8	7.97	9	83	
				50					
15-Oct	Gwillim	Lake	S1		10	8.08	10	91	
			S2		10	8.07	9	90	
			S3		9	9.50	8	76	
			S4		9	8.01	10	90	
15-Oct	Moberly	Lake	P1	0		8.05			
			P1	42		7.88			
			S1		9	8.08	10	91	
			S2		9	7.96	10	89	
			S3		9	8.40	11	97	
			S4		8	8.02	10	92	
			S5		9	8.17	10	94	
18-Oct	Gwillim	Lake	P1						5.9
8-Nov	Moberly	Lake	P1	0	0				5.0

APPENDIX I: Physical water sampling

JUNE

Date	System/Station		Bar.	Depth	Temp.	pH	Dissolved Oxygen		Secchi
			mmHg	m	'C		mg/L	% sat	m
7-Jun	Gwillim Creek		689		9	8.17	10	94	
	Smokehouse Creek		688		10	8.01	10	91	
	Meikle Creek		689		12	8.30	9	97	
9-Jun	Gwillim Lake	P2	693	0	10	8.20	10	101	1.88
				2	10				
				5	10				
				10	9		11	99	
				15	8				
				20	7		11	96	
				42	5	8.02	10	90	
	Gwillim Lake	P1	693	0	8	8.20	11	98	1.52
				2	8				
				5	8				
				10	8		11	97	
				15	7				
				20	7		11	96	
				45	5	8.17	10	89	
9-Jun	Gwillim Lake	S-1			10	8.07	10	96	
		S-2			11	8.17	10	99	
		S-3			g	8.16	11	97	
		S-4			8	8.16	10	97	
10-Jun	Moberly Lake	P1	698	0	10	7.97	10	100	0.90
				2	10				
				5	8				
				10	7		10	92	
				20	7		11	94	
				42	5	7.72	10	89	
	Moberly Lake	P2	698	0	11	7.99	10	100	1.10
				2	11				
				5	9				
				10	8		10	96	
				15	7				
				20	6		10	91	
				28	6	7.83	10	89	
	Moberly Lake	S-1			12	8.00	11	106	
		S-2			10	7.85	10	94	
		S-3			11	7.96	10	100	
		S-4			12	8.00	11	106	
		S-5			11	7.92	10	99	
11-Jun	West Moberly River		695		7		10	90	

APPENDIX I: Physical water sampling

AUGUST

Date	System/Station	Bar. mmHg	Depth m	Temp. C	pH	Dissolved Oxygen mg/L	Dissolved Oxygen % sat	Secchi m
Aug 11	Moberly Lake P1	711	0	19	8.32	9	105	2.78
			2	18				
			5	16				
			10	14		8	103	
			15	11				
			20	8		9	79	
			30	6				
			40	6	7.72	9	73	
Aug 11	Moberly Lake P2	710	0	20	8.24	9	103	3.20
			2	17				
			5	17				
			10	14		8	88	
			15	13				
			20	11		9	83	
			25	9	7.73	9	81	
Aug 11	Moberly Lake S2	709		27	8.42	10	140	
	S1			27	8.38	10	133	
	S3			26	8.33	9	113	
	S4			24	8.25	9	112	
	S5			26	8.29	9	118	
	S6			27	8.58	10	136	
	S7			27	8.81	11	143	
	Moberly River			23	7.93	8	98	
Aug 12	Gwillim Lake S1	699		19	8.28	9	111	
	S2			19	8.35	9	106	
	S3			19	8.30	9	108	
	S4			20	8.24	9	111	
Aug 12	Gwillim Lake P1	698	0	19	8.43	9	108	3.75
			2	18				
			5	15				
			10	13		9	94	
			15	9				
			20	7		10	86	
			30	6				
			45	6	7.84	9	82	
Aug 12	Gwillim Lake P2	699	0	20	8.35	9	107	3.83
			2	18				
			5	16				
			10	13		9	93	
			15	9				
			20	7		10	86	
			30	6				
			40	6	7.85	10	83	
Aug 12	Smokehouse Creek	694		12	8.07	9	90	

GWILLIM LAKE

Date	Water Level (m)	Temperature (C) max	Temperature (C) min	Comments
18 Oct, 1989	1.23	8	8	Thermometer set at 5 m
26 Oct, 1989	1.23	8	8	
02 Nov, 1989	1.20	8	8	
09 Nov, 1990	1.21	7	7	
16 Nov, 1989	1.20	4	4	
23 Nov, 1989	1.20	5	5	
30 Nov, 1989	1.23	8	8	
07 Dec, 1989	1.21	3	3	
14 Dec, 1989	1.14	1	1	
21 Dec, 1989	0.50	1	-1	Ice removed staff gauge, replacement approx.
28 Dec, 1989	0.54	3	-1	
04 Jan, 1990	0.50	3	0	
11 Jan, 1990	0.50	3	0	
18 Jan, 1990	0.50	3	0	Ice removed staff gauge, replacement approx.
25 Jan, 1990	0.50	3	0	
01 Feb. 1990	0.50	3	3	
08 Feb. 1990		-2	-2	Ice keeps moving gauge
15 Feb, 1990		-2	-2	"
22 Feb, 1990		2	2	"
01 Mar, 1990		3	3	"
08 Mar, 1990		3	3	"
15 Mar, 1990		3	3	"
22 Mar, 1990		3	3	"
29 Mar, 1990		3	3	
05 Apr, 1990	1.25	3	3	Break-up began Apr 1
12 Apr, 1990	1.28	3	3	
19 Apr, 1990	1.30	4	4	Reset therm, at 1.2 m. West end clear of ice.
26 Apr, 1990		10		
03 May, 1990	1.51	11		
10 May, 1990	1.65	6		
17 May, 1990	1.64	5		
24 May, 1990	1.67	8		
31 May, 1990	1.39	9		
07 Jun, 1990	2.20	8		
14 Jun, 1990	overtopped	13	8	
21 Jun, 1990	2.26	12	9	Freshet removed gauge, replacement approx.
28 Jun, 1990	1.74	10	9	
05 Jul, 1990	1.66	16	15	
12 Jul, 1990	1.57	20	18	
19 Jul, 1990	1.54	17	13	
26 Jul, 1990	1.39	19	17	
02 Aug. 1990	1.33	18	15	
09 Aug. 1990	1.28	17	16	
16 Aug, 1990	1.29	19	17	
23 Aug, 1990	1.29	16	15	
30 Aug, 1990	1.28	15	12	
06 Sep, 1990	1.27	14	12	
13 Sep, 1990	1.27	16	13	

Moberly Lake at outlet

Date	Water Level (m)	Temperature (C) max	min
15 Nov, 89	1.10	3	-1
22 Nov, 89	1.10	3	1
29 Nov, 89	1.10	3	1
6 Dec, 89	1.09	2	0
13 Dec, 89	1.09	2	0
20 Dec, 89	1.09	3	0
3 Jan, 90	0.90	Thermometer stolen	
10 Jan, 90	0.90		
17 Jan, 90	0.80		
24 Jan, 90	0.70		
31 Jan, 90	0.60		
8 Feb, 90	0.90		
15 Feb, 90			
22 Feb, 90	0.90		
28 Feb, 90	0.90		
8 Mar, 90	0.90		
15 Mar, 90	0.90		
22 Mar, 90	0.90		
29 Mar, 90	0.90		
5 Apr, 90	1.50		
12 Apr, 90	1.80		
19 Apr, 90	2.10		
26 Apr, 90	overtopped		
3 May, 90	overtopped		
10 May, 90	overtopped		
17 May, 90	overtopped		
24 May, 90	overtopped		
31 May, 90	overtopped		
14 Jun, 90	0.8*		15
21 Jun, 90	0.52	22	9
27 Jun, 90	0.00	Thermometer stolen	
4 Jul, 90	0.75		
9 Jul, 90	0.66		
15 Jul, 90	0.40		
21 Jul, 90	0.40		
26 Jul, 90	0.20		
2 Aug, 90	0.10		
10 Aug, 90	0.10		
15 Aug, 90	0.07		

* new gauge

Moberly River above lake

Date	Water Level (m)	Temperature (C) max	min
8 Nov, 89	1	Thermometer iced in	
16 Nov, 89	1		
23 Nov, 89	2		
30 Nov, 89	2		
6 Dec, 89	2		
13 Dec, 89	2		
20 Dec, 89	2		
27 Dec, 89	2		
3 Jan, 90	2		
10 Jan, 90	2		
17 Jan, 90	2		
24 Jan, 90			
31 Jan, 90	2		
7 Feb, 90	2		
14 Feb, 90			
21 Feb, 90	2		
28 Feb, 90	2		
7 Mar, 90	2		
14 Mar, 90	1		
21 Mar, 90	1		
28 Mar, 90	bank slough	Ice out	
4 Apr, 90	2		
11 Apr, 90	2		
18 Apr, 90	road out		
25 Apr, 90	"		
3 May, 90	"		
10 May, 90	overtopped		
17 May, 90	"		
24 May, 90	"		
31 May, 90	5	Peak est @ 4.5 m	
6 Jun, 90			
13 Jun, 90			
20 Jun, 90	"		
27 Jun, 90	2	10	5
3 Jul, 90	2	9	5
12 Jul, 90	2	19	9
17 Jul, 90	1	19	16
21 Jul, 90	1	20	15
26 Jul, 90	1	22	12
2 Aug, 90	1	22	12
8 Aug, 90	1	25	11
14 Aug, 90	1		

* Gauge & benchmark replaced. Calibration approximate

North shore of Moberly Lake

Date	Temperature (C)	
	max	min
21 Jun, 90	19	13
27 Jun, 90	19	13
3 Jui, 90	19	12
12 Jul, 90	24	22
17 Jul, 90	29	21
21 Jul, 90	30	21
2 Aug. 90	29	21
8 Aug. 90	38	18
15 Aug. 90	32	18

APPENDIX III: Shoreline Characteristics

Station or Location	Distance to 1 m isobath (m)	Substrate				Dense Vegetation %	Total Cover (%)
		Fine (%)	Gravel (%)	Cobble (%)	Boulder & Bedrock (%)		
Moberly Lake, clockwise from west Moberly River mouth							
		100	0	0	0		
S7	100	100	0	0	0	100	100
	100	100	0	0	0		
	100	100	0	0	0		
	100	100	0	0	0		
	100	100	0	0	0		
	70	70	30	30	30		
	100	10	40	40	10		
	400	10	20	60	10		
	100	20	10	40	30		
	60	10	10	40	40		
	200	0	10	70	20		
	100	20	10	60	10		
S1		0	10	70	20	20	5
		40	30	20	10		
		10	70	20	0		
		10	90	0	0		
		100	0	0	0		
		10	10	70	10		
		10	70	10	10		
		10	60	30	0		
		0	10	80	10		
		0	20	60	20		
		0	20	70	10		
S3		0	30	70	0	10	1
		0	30	50	20		
		0	10	80	10		
		0	10	10	70		
		95	0	0	5		
		30	20	30	20		
		30	10	40	20		
		30	20	30	20		
	20	60	20	20	0		
	15	0	50	50	0		
	10	50	50	0	0		
S5	10	100	0	0	0	100	80
	10	100	0	0	0		
	25	10	10	40	40		
	60	10	10	40	40		
	7	0	50	50	0		
	10	100	0	0	0		
	10	100	0	0	0		
	200	100	0	0	0		
S6	250	100	0	0	0	10	1
	300	100	0	0	0		

APPENDIX III: Shoreline Characteristics

Station or Location	Distance to 1 m isobath (m)	Substrate				Dense Vegetation %	Total Cover (%)
		Fine (%)	Gravel (%)	Cobble (%)	Boulder & Bedrock (%)		
Moberly River outlet							
	250	100	0	0	0		
	200	100	0	0	0		
	20	80	10	10	0		
	25	10	40	50	0		
	10	0	10	90	0		
	20	100	0	0	0		
	10	10	30	50	10		
	25	100	0	0	0		
	100	100	0	0	0		
	20	90	10	0	0		
	8	70	30	0	0		
	30	40	20	40	0		
	120	100	0	0	0		
	80	20	20	30	30		
		100	0	0	0		
S4	40	20	70	10	0	80	60
		100	0	0	0		
	15	100	0	0	0		
	30	60	40	0	0		
	4	0	100	0	0		
	4	0	100	0	0		
	10	50	50	0	0		
	7	0	30	40	30		
	40	100	0	0	0		
	70	100	0	0	0		
	30	10	40	40	10		
	30	30	10	50	10		
S2	20	10	10	60	20	10	5
	20	20	10	40	30		
	20	50	20	30	0		
	60	100	0	0	0		
	15	100	0	0	0		
	40	100	0	0	0		
	30	100	0	0	0		
	40	90	0	10	0		
	150	100	0	0	0		
	450	100	0	0	0		
	10	100	0	0	0		
West Moberly Mouth							
Means	74	53	18	22	8	47	36

APPENDIX III: Shoreline Characteristics

Station or Location	Distance to 1 m isobath (m)	Substrate				Dense Vegetation %	Total Cover (%)
		Fine (%)	Gravel (%)	Cobble (%)	Boulder & Bedrock (%)		
Gwillim Lake: Clockwise from mouth of Smokehouse Creek							
	10	30	40	30	0		
	15	100	0	0	0		
	10	20	40	40	0		
	12	100	0	0	0		
	25	100	0	0	0		
	10	50	30	20	0		
	20	40	30	30	0		
	15	100	0	0	0		
	20	60	40	0	0		
	20	80	0	20	0		
S4	80	0	80	20	0	0	0
	7	20	80	0	0		
	5	100	0	0	0		
	5	50	50	0	0		
	60	40	20	40	0		
	7	100	0	0	0		
	10	50	50	0	0		
	75	80	10	10	0		
	75	0	0	50	50		
	10	0	0	50	50		
	10	50	10	40	0		
	10	0	0	100	0		
	10	0	0	50	50		
	10	20	80	0	0		
	8	100	0	0	0		
	20	50	0	50	0		
	8	50	10	40	0		
	7	30	40	30	0		
	10	30	40	30	0		
	10	30	40	30	0		
	10	50	0	50	0		
	10	60	0	40	0		
	15	0	0	100	0		
	20	83	1	12	4		
	15	100	0	0	0		
	15	0	0	50	50		
	10	50	25	25	0		
S2	10	0	20	80	0	20	5
	10	50	10	40	0		
	20	50	10	40	0		
	50	100	0	0	0		

APPENDIX III: Shoreline Characteristics

Station or Location	Distance to 1 m isobath (m)	Substrate				Dense Vegetation %	Total Cover (%)
		Fine (%)	Gravel (%)	Cobble (%)	Boulder & Bedrock (%)		
Gwillim River outlet							
	150	100	0	0	0	100	100
	100	100	0	0	0		
	25	100	0	0	0		
	20	100	0	0	0		
		83	5	10	2		
S1		0	30	50	20	80	0
	15	50	40	10	0		
	8	50	25	25	0		
	8	20	40	40	0		
	6	50	15	35	0		
	6	50	15	35	0		
	6	0	25	50	25		
	6	50	0	25	25		
	6	25	7	34	34		
	6	25	7	34	34		
	6	25	7	34	34		
	6	0	40	50	10		
	6	50	25	25	0		
	6	50	25	25	0		
	6	50	25	25	0		
	6	50	25	25	0		
	15	95	2	3	0		
	8	55	40	10	0		
	6	10	20	70	0		
S3	6	10	20	70	0	40	10
	8	70	10	20	0		
	8	80	10	10	0		
	6	100	0	0	0		
Meikle Ck	8	10	30	60	0		
	10	100	0	0	0		
	10	100	0	0	0		
	10	100	0	0	0		
	8	100	0	0	0		
	2	100	0	0	0		
	7	80	20	0	0		
	10	30	40	30	0		
MEANS	17	53	17	25	5	48	23

APPENDIX IV: Fish catch summary

Date	Site	Method	Length (m)	Width (m)	M depth (m)	Duration (hr)	Arctic grayling	Bull trout	Burbot	Cottid	Lake char	Lake w fish	Mount. w fish	North pike	Pearl Dace	R bow trout	Sucker	Trout perch	UID	Total catch
Jun 05	ML	Trawl			5.0	0.17						37						2		39
Jun 05	ML	Trawl			10.0	0.17						4						1		
Jun 05	ML	Trawl			5.0	0.17						1								1
Jun 05	ML	Trawl			0.0	0.17						1								1
Jun 06	CL	Trawl			10.0	0.27														0
Jun 06	CL	Trawl			10.0	0.27														0
Jun 06	CL	Trawl			5.0	0.27														0
Jun 06	CL	Trawl			0.0	0.30														0
Jun 06	CL	Trawl			0.0	0.25														0
Jun 06	CL	Trawl			5.0	0.25														0
Jun 07	ML	Seine			0.5					2		1		1	13		1			18
Aug 09	MR	Seine	30	30	1.0								33							33
Aug 13	ML	Seine	75	25	1.0					12							29	4	4	49
Aug 13	ML	Seine	55	25	1.0					13				1			6	5		25
Aug 13	ML	Seine	60	25	1.0				7	8							6	2		23
Aug 14	ML	Trawl			0.0	0.17														0
Aug 14	ML	Trawl			5.0	0.17				1		1					3			5
Aug 14	ML	Trawl			10.0	0.17				3		1							1	5
Aug 14	ML	Trawl			10.0	0.17				2		2								4
Aug 14	ML	Trawl			5.0	0.17											1			1
Aug 14	ML	Trawl			0.0	0.17				5										5
Aug 15	ML	Gillnet	76.2			15.00			1	2		7		22			6			38
Aug 15	CL	Trawl			10.0	0.17														0
Aug 15	CL	Trawl			5.0	0.17														0
Aug 15	CL	Trawl			0.0	0.17														0
Aug 15	CL	Trawl			0.0	0.17														0
Aug 15	CL	Trawl			5.0	0.17						2								2
Aug 15	CL	Trawl			10.0	0.17														0
Aug 17	CL	Gillnet	76.2			16.50	2					23		1		1	3			30
Aug 17	SC	Shocker	19.5	5.4						33										33
Aug 17	SC	Shocker								11						1				12
Aug 17	SC	Shocker	28	7					1	30							1			32
Aug 17	CL	Gillnet	76.2			7.83					1	1								2
Aug 17	CL	Seine	25	25	0.5				5	10				1			115			131
Aug 17	CL	Seine	25	25	1.0				1	1							2			4
Aug 18	CL	Gillnet	76.2			14.50						10					5			15
Aug 18	ML	Seine	25	20	1.1					13				1			9			23

APPENDIX IV. Fish catch summary

Date	Site	Method	Length (m)	Width (m)	M depth (m)	Duration (hr)	Arctic grayling	Bull trout	Burbot	Cottid	Lake char	Lake w fish	Mount. w fish	North. pike	Pearl Dace	R bow trout	Sucker	Trout perch	UID	Total catch
Aug 18	ML	Seine	25	40	1.1				1	31				1			40	3		76
Aug 18	ML	Seine	25	40	1.1				1	19							4	16		40
Aug 18	ML	Seine	25	30	0.6				7	1				4			3			15
Aug 18	ML	Seine	25	30	0.6				7	1				6						14
Aug 19	ML	Gillnet	76.2			18			2			19		1			1			23
Aug 19	ML	Gillnet	76.2			6						20		1						21
Aug 20	ML	Gillnet	76.2			20					3	48					4			55
Sep 26	GL	Gillnet	76.2			24		2	1			37								40
Sep 26	GL	Gillnet	76.2			24			4		3	16					7			30
Sep 26	GL	Gillnet	76.2			24		1			2	5								8
Sep 26	GL	Gillnet	76.2			24			4		4	5								13
Sep 26	GL	Gillnet	76.2			24														0
Sep 27	ML	Gillnet	76.2			24			1		1	37					5			44
Sep 27	ML	Gillnet	76.2			24					1	31					2			34
Sep 27	ML	Gillnet	76.2			24			1		1	80		3			1			86
Sep 27	ML	Gillnet	76.2			24					6	23					4			33
Sep 28	ML	Gillnet	76.2			24			2		1	23					2			28
Sep 28	ML	Gillnet	76.2			24			1		1	28		8			1			39
Sep 28	ML	Gillnet	76.2			24					1	6					1			8
Sep 28	ML	Gillnet	76.2			24					6	13		4			5			28
Sep 29	ML	Gillnet	76.2			24						25		2			1			28
Totals							2	3	47	198	31	507	33	57	13	2	268	33	5	1,194

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Jun 04/00	Trawl	1	LW	123	20.00			1	2		
Moberly L.	Jun 04/00	Trawl	2	LW	130	23.00			2	2		
Moberly L.	Jun 04/00	Trawl	3	LW	121	15.00			3	2		
Moberly L.	Jun 04/00	Trawl	4	LW	130	20.00			4	2		
Moberly L.	Jun 04/00	Trawl	5	LW	82	4.45			5	1		
Moberly L.	Jun 04/00	Trawl	6	LW	90	6.55			6	1		
Moberly L.	Jun 04/00	Trawl	7	LW	90	6.55			7	1		
Moberly L.	Jun 04/00	Trawl	8	LW	95	7.75			8	1		
Moberly L.	Jun 04/00	Trawl	9	LW	74	3.70			9	1		
Moberly L.	Jun 04/00	Trawl	10	LW	77	4.30			10	1		
Moberly L.	Jun 04/00	Trawl	11	LW	88	5.90			11	1		
Moberly L.	Jun 04/00	Trawl	12	LW	78	4.05			12	1		
Moberly L.	Jun 04/00	Trawl	13	LW	78	4.15			13	1		
Moberly L.	Jun 04/00	Trawl	14	LW	78	4.45			14	1		
Moberly L.	Jun 04/00	Trawl	15	LW	73	3.35			15	1		
Moberly L.	Jun 04/00	Trawl	16	LW	73	3.10			16	1		
Moberly L.	Jun 04/00	Trawl	17	LW	73	3.05			17	1		
Moberly L.	Jun 04/00	Trawl	18	LW	73	3.50			18	1		
Moberly L.	Jun 04/00	Trawl	19	LW	70	2.75			19	1		
Moberly L.	Jun 04/00	Trawl	20	LW	52	1.25						
Moberly L.	Jun 04/00	Trawl	21	LW	55	1.25						
Moberly L.	Jun 04/00	Trawl	22	LW	48	0.95						
Moberly L.	Jun 04/00	Trawl	23	LW	51	1.00						
Moberly L.	Jun 04/00	Trawl	24	LW	48	0.90						
Moberly L.	Jun 04/00	Trawl	25	LW	47	0.70						
Moberly L.	Jun 04/00	Trawl	26	LW	48	0.95						
Moberly L.	Jun 04/00	Trawl	27	LW	45	0.65						
Moberly L.	Jun 04/00	Trawl	28	LW	52	1.15						
Moberly L.	Jun 04/00	Trawl	29	LW	50	0.90						
Moberly L.	Jun 04/00	Trawl	30	LW	55	1.35						
Moberly L.	Jun 04/00	Trawl	31	LW	55	1.10						
Moberly L.	Jun 04/00	Trawl	32	LW	48	1.05						
Moberly L.	Jun 04/00	Trawl	33	LW	50	1.00						
Moberly L.	Jun 04/00	Trawl	34	LW	50	0.95						
Moberly L.	Jun 04/00	Trawl	35	LW	48	0.80						
Moberly L.	Jun 04/00	Trawl	36	LW	48	0.75						
Moberly L.	Jun 04/00	Trawl	37	LW	51	0.95						
Moberly L.	Jun 04/00	Trawl	38	TP	62	2.85						
Moberly L.	Jun 04/00	Trawl	39	TP	26	0.25						
Moberly L.	Jun 04/00	Trawl	40	LW	82	4.90			40	1		
Moberly L.	Jun 04/00	Trawl	41	LW	83	4.75			41	1		
Moberly L.	Jun 04/00	Trawl	42	LW	51	1.05						
Moberly L.	Jun 04/00	Trawl	43	LW	50	0.95						
Moberly L.	Jun 04/00	Trawl	44	TP	54	1.85						
Moberly L.	Jun 04/00	Trawl	45	LW	55	1.75			45	0		
Moberly L.	Jun 04/00	Trawl	46	LW	130	21.15			46	2		
Moberly L.	Jun 05/00	Seine	1	LSS	430	1200.00						
Moberly L.	Jun 05/00	Seine	2	LW	270	250.00	F	I	2			
Moberly L.	Jun 05/00	Seine	3	NP	130	16.70						
Moberly L.	Jun 05/00	Seine	4	SS	55	2.05						
Moberly L.	Jun 05/00	Seine	5	SS	45	1.00						
Moberly L.	Jun 05/00	Seine	6	NPD	55	1.95						
Moberly L.	Jun 05/00	Seine	7	NPD	60	2.40						
Moberly L.	Jun 05/00	Seine	8	NPD	48	1.05						
Moberly L.	Jun 05/00	Seine	9	NPD	28	0.35						
Moberly L.	Jun 05/00	Seine	10	NPD	28	0.30						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-unity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Jun 05/00	Seine	11	NPD	25	0.20						
Moberly L.	Jun 05/00	Seine	12	NPD	28	0.30						
Moberly L.	Jun 05/00	Seine	13	NPD	21	0.15						
Moberly L.	Jun 05/00	Seine	14	NPD	30	0.35						
Moberly L.	Jun 05/00	Seine	15	NPD	25	0.25						
Moberly L.	Jun 05/00	Seine	16	NPD	23	0.20						
Moberly L.	Jun 05/00	Seine	17	NPD	28	0.30						
Moberly L.	Jun 05/00	Seine	18	NPD	32	0.45						
Moberly R.	Aug 09/15	Seine	1	LW	65	2.95	.	.	1	1		
Moberly R.	Aug 09/15	Seine	2	LW	56	1.90	.	.	2	1		
Moberly R.	Aug 09/15	Seine	3	LW	65	2.90	.	.	3	1		
Moberly R.	Aug 09/15	Seine	4	LW	52	1.55	.	.	4	1		
Moberly R.	Aug 09/15	Seine	5	LW	58	2.20	.	.	5	1		
Moberly R.	Aug 09/15	Seine	6	LW	59	2.00	.	.	6	1		
Moberly R.	Aug 09/15	Seine	7	LW	62	2.30	.	.	7	1		
Moberly R.	Aug 09/15	Seine	8	LW	50	1.30	.	.	8	1		
Moberly R.	Aug 09/15	Seine	9	LW								
Moberly R.	Aug 09/15	Seine	10	LW								
Moberly R.	Aug 09/15	Seine	11	LW								
Moberly R.	Aug 09/15	Seine	12	LW								
Moberly R.	Aug 09/15	Seine	13	LW								
Moberly R.	Aug 09/15	Seine	14	LW								
Moberly R.	Aug 09/15	Seine	15	LW								
Moberly R.	Aug 09/15	Seine	16	LW								
Moberly R.	Aug 09/15	Seine	17	LW								
Moberly R.	Aug 09/15	Seine	18	LW								
Moberly R.	Aug 09/15	Seine	19	LW								
Moberly R.	Aug 09/15	Seine	20	LW								
Moberly R.	Aug 09/15	Seine	21	LW								
Moberly R.	Aug 09/15	Seine	22	LW								
Moberly R.	Aug 09/15	Seine	23	LW								
Moberly R.	Aug 09/15	Seine	24	LW								
Moberly R.	Aug 09/15	Seine	25	LW								
Moberly R.	Aug 09/15	Seine	26	LW								
Moberly R.	Aug 09/15	Seine	27	LW								
Moberly R.	Aug 09/15	Seine	28	LW								
Moberly R.	Aug 09/15	Seine	29	LW								
Moberly R.	Aug 09/15	Seine	30	LW								
Moberly R.	Aug 09/15	Seine	31	LW								
Moberly R.	Aug 09/15	Seine	32	LW								
Moberly R.	Aug 09/15	Seine	33	LW								
Moberly L.	Aug 09/21	Seine	1	?	75	5.50						
Moberly L.	Aug 09/21	Seine	2	?	50	1.55						
Moberly L.	Aug 09/21	Seine	3	TP	44	1.05						
Moberly L.	Aug 09/21	Seine	4	TP	40	0.90						
Moberly L.	Aug 09/21	Seine	5	CCG	52	1.20						
Moberly L.	Aug 09/21	Seine	6	CCG	49	1.20						
Moberly L.	Aug 09/21	Seine	7	CCG	45	0.95						
Moberly L.	Aug 09/21	Seine	8	TP	57	2.00						
Moberly L.	Aug 09/21	Seine	9	?	50	1.70						
Moberly L.	Aug 09/21	Seine	10	CCG	54	1.65						
Moberly L.	Aug 09/21	Seine	11	TP	40	0.90						
Moberly L.	Aug 09/21	Seine	12	CCG	43	0.95						
Moberly L.	Aug 09/21	Seine	13	CCG	43	0.95						
Moberly L.	Aug 09/21	Seine	14	CCG	72	3.60						
Moberly L.	Aug 09/21	Seine	15	CCG	51	1.70						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 09/21	Seine	16	?	31	0.25						
Moberly L.	Aug 09/21	Seine	17	CCG	55	1.85						
Moberly L.	Aug 09/21	Seine	18	CCG	53	1.25						
Moberly L.	Aug 09/21	Seine	19	CCG	58	2.05						
Moberly L.	Aug 09/21	Seine	20	SU	42	0.60						
Moberly L.	Aug 09/21	Seine	21	WSU	39	0.35						
Moberly L.	Aug 09/21	Seine	22	WSU	30	0.25						
Moberly L.	Aug 09/21	Seine	23	WSU	40	0.55						
Moberly L.	Aug 09/21	Seine	24	WSU	46	1.05						
Moberly L.	Aug 09/21	Seine	25	WSU	37	0.55						
Moberly L.	Aug 09/21	Seine	26	WSU	81	5.70						
Moberly L.	Aug 09/21	Seine	27	SU	45	0.85						
Moberly L.	Aug 09/21	Seine	28	SU	44	0.90						
Moberly L.	Aug 09/21	Seine	29	SU	40	0.70						
Moberly L.	Aug 09/21	Seine	30	SU	41	0.75						
Moberly L.	Aug 09/21	Seine	31	SU	44	0.95						
Moberly L.	Aug 09/21	Seine	32	SU	47	1.10						
Moberly L.	Aug 09/21	Seine	33	SU	44	0.90						
Moberly L.	Aug 09/21	Seine	34	Su	48	1.15						
Moberly L.	Aug 09/21	Seine	35	SU	42	0.75						
Moberly L.	Aug 09/21	Seine	36	SU	38	0.60						
Moberly L.	Aug 09/21	Seine	37	SU	43	0.75						
Moberly L.	Aug 09/21	Seine	38	SU	44	0.90						
Moberly L.	Aug 09/21	Seine	39	SU	35	0.45						
Moberly L.	Aug 09/21	Seine	40	SU	45	0.90						
Moberly L.	Aug 09/21	Seine	41	SU	47	1.15						
Moberly L.	Aug 09/21	Seine	42	SU	36	0.50						
Moberly L.	Aug 09/21	Seine	43	SU	38	0.50						
Moberly L.	Aug 09/21	Seine	44	SU	48	1.10						
Moberly L.	Aug 09/21	Seine	45	CCG	27	0.30						
Moberly L.	Aug 09/21	Seine	46	SU	44	0.90						
Moberly L.	Aug 09/21	Seine	47	SU	41	0.75						
Moberly L.	Aug 09/21	Seine	48	SU	45	1.00						
Moberly L.	Aug 09/21	Seine	49	SU	438							
Moberly L.	Aug 09/22	Seine	1	SU	46	0.85						
Moberly L.	Aug 09/22	Seine	2	TP	54	1.60						
Moberly L.	Aug 09/22	Seine	3	TP	42	0.75						
Moberly L.	Aug 09/22	Seine	4	SU	32	0.30						
Moberly L.	Aug 09/22	Seine	5	TP	23	0.10						
Moberly L.	Aug 09/22	Seine	6	TP	24	0.20						
Moberly L.	Aug 09/22	Seine	7	CCG	46	0.95						
Moberly L.	Aug 09/22	Seine	8	CCG	59	1.95						
Moberly L.	Aug 09/22	Seine	9	CCG	49	1.05						
Moberly L.	Aug 09/22	Seine	10	SU	43	0.85						
Moberly L.	Aug 09/22	Seine	11	CCG	24	0.15						
Moberly L.	Aug 09/22	Seine	12	CCG	50	1.10						
Moberly L.	Aug 09/22	Seine	13	TP	26	0.75						
Moberly L.	Aug 09/22	Seine	14	SU	40	0.70						
Moberly L.	Aug 09/22	Seine	15	CCG	25	0.15						
Moberly L.	Aug 09/22	Seine	16	CCG	23	0.10						
Moberly L.	Aug 09/22	Seine	17	CCG	39	0.60						
Moberly L.	Aug 09/22	Seine	18	CCG	41	0.65						
Moberly L.	Aug 09/22	Seine	19	SU	45	0.95						
Moberly L.	Aug 09/22	Seine	20	CCG	46	0.75						
Moberly L.	Aug 09/22	Seine	21	CCG	47	0.95						
Moberly L.	Aug 09/22	Seine	22	WSU	100	10.75						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 09/22	Seine	23	CCG	49	1.10						
Moberly L.	Aug 09/22	Seine	24	CCG	49	1.05						
Moberly L.	Aug 09/22	Seine	25	NP	204	65.50						
Moberly L.	Aug 09/22	Seine	1	SU	46	0.80						
Moberly L.	Aug 09/22	Seine	2	SU	50	1.30						
Moberly L.	Aug 09/22	Seine	3	SU	47	1.05						
Moberly L.	Aug 09/22	Seine	4	SU	47	0.90						
Moberly L.	Aug 09/22	Seine	5	SU	29	0.35						
Moberly L.	Aug 09/22	Seine	6	CCG	53	1.40						
Moberly L.	Aug 09/22	Seine	7	CCG	49	1.25						
Moberly L.	Aug 09/22	Seine	8	CCG	47	1.45						
Moberly L.	Aug 09/22	Seine	9	CCG	48	1.40						
Moberly L.	Aug 09/22	Seine	10	CCG	36	0.60						
Moberly L.	Aug 09/22	Seine	11	CCG	41	0.85						
Moberly L.	Aug 09/22	Seine	12	CCG	59	1.75						
Moberly L.	Aug 09/22	Seine	13	CCG	47	1.10						
Moberly L.	Aug 09/22	Seine	14	TP	60	2.40						
Moberly L.	Aug 09/22	Seine	15	TP	31	0.40						
Moberly L.	Aug 09/22	Seine	16	BB	74	2.70						
Moberly L.	Aug 09/22	Seine	17	BB	114	8.70						
Moberly L.	Aug 09/22	Seine	18	BB	56	1.40						
Moberly L.	Aug 09/22	Seine	19	BB	74	1.90						
Moberly L.	Aug 09/22	Seine	20	BB	71	1.90						
Moberly L.	Aug 09/22	Seine	21	BB	74	1.40						
Moberly L.	Aug 09/22	Seine	22	BB	63	1.30					2	
Moberly L.	Aug 09/22	Seine	23	CSU	424							
Moberly L.	Aug 14/22	Trawl	1	LW	91	9.65			1	1		
Moberly L.	Aug 14/22	Trawl	2	SU	31	0.45						
Moberly L.	Aug 14/22	Trawl	3	SU	33	0.45						
Moberly L.	Aug 14/22	Trawl	4	SU	32	0.35						
Moberly L.	Aug 14/22	Trawl	5	CC	20	0.05						
Moberly L.	Aug 14/22	Trawl	1	LW	52	1.20			1	1		
Moberly L.	Aug 14/22	Trawl	2	?	33	0.25						
Moberly L.	Aug 14/22	Trawl	3	CC	21	0.05						
Moberly L.	Aug 14/22	Trawl	4	CC	21	0.05						
Moberly L.	Aug 14/22	Trawl	5	CC	20	0.50						
Moberly L.	Aug 14/23	Trawl	1	CC	22	0.10						
Moberly L.	Aug 14/23	Trawl	2	CC	26	0.10						
Moberly L.	Aug 14/23	Trawl	3	LW	90	9.25			2	1		
Moberly L.	Aug 14/23	Trawl	4	LW	164	55.75			3	2		
Moberly L.	Aug 14/23	Trawl	1	SU	38	0.55						
Moberly L.	Aug 14/23	Trawl	1	CCG	49	1.05						
Moberly L.	Aug 14/23	Trawl	2	CC	21	0.05						
Moberly L.	Aug 14/23	Trawl	3	CC	20	0.05						
Moberly L.	Aug 14/23	Trawl	4	CC	20	0.05						
Moberly L.	Aug 14/23	Trawl	5	CC	19	0.05						
Moberly L.	Aug 15/10	Gillnet	1	NP	864	3900.00	M	A	1			
Moberly L.	Aug 15/10	Gillnet	2	NP	544	1150.00	M	A	2			
Moberly L.	Aug 15/10	Gillnet	3	NP	639	1475.00	M	A	3			
Moberly L.	Aug 15/10	Gillnet	4	NP	550	1000.00	F	A	4			
Moberly L.	Aug 15/10	Gillnet	5	NP	648	1775.00	F	A	5			
Moberly L.	Aug 15/10	Gillnet	6	NP	557	975.00	M	A	6			
Moberly L.	Aug 15/10	Gillnet	7	NP	495	1025.00	F	A	7			
Moberly L.	Aug 15/10	Gillnet	8	NP	531	875.00	F	A	8			
Moberly L.	Aug 15/10	Gillnet	9	NP	452	575.00	M	A	9			
Moberly L.	Aug 15/10	Gillnet	10	NP	450	625.00	F	A	10			

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-unty	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 15/10	Gillnet	11	NP	442	650.00	M	A	11			
Moberly L.	Aug 15/10	Gillnet	12	NP	488	725.00	M	A	12			
Moberly L.	Aug 15/10	Gillnet	13	NP	413	425.00	M	A	13			
Moberly L.	Aug 15/10	Gillnet	14	NP	372	355.00	M	A	14			
Moberly L.	Aug 15/10	Gillnet	15	NP	393	400.00	F	A	15			
Moberly L.	Aug 15/10	Gillnet	16	NP	348	265.00	.	J	16			
Moberly L.	Aug 15/10	Gillnet	17	NP	420	375.00	M	A	17			
Moberly L.	Aug 15/10	Gillnet	18	NP	308	200.00	F	A	18			
Moberly L.	Aug 15/10	Gillnet	19	NP	360	345.00	F	A	19			
Moberly L.	Aug 15/10	Gillnet	20	NP	350	375.00	.	J	20			
Moberly L.	Aug 15/10	Gillnet	21	NP	330	235.00	.	J	21			
Moberly L.	Aug 15/10	Gillnet	22	NP	237	95.00	.	J	22			
Moberly L.	Aug 15/10	Gillnet	23	LW	402	975.00	F	M	1	9		
Moberly L.	Aug 15/10	Gillnet	24	LW	387	650.00	F	M	2	7		
Moberly L.	Aug 15/10	Gillnet	25	LW	366	475.00	F	M	3	7		
Moberly L.	Aug 15/10	Gillnet	26	LW	356	490.00	F	M	4	7		
Moberly L.	Aug 15/10	Gillnet	27	LW	298	275.00	F	M	5	6		
Moberly L.	Aug 15/10	Gillnet	28	LW	214	115.00		J	6	3		
Moberly L.	Aug 15/10	Gillnet	29	LW	157	40.00		J	7	2		
Moberly L.	Aug 15/10	Gillnet	30	CSU	107	12.25						
Moberly L.	Aug 15/10	Gillnet	31	BB	375	325.00					5	
Moberly L.	Aug 15/10	Gillnet	32	CC	50							
Moberly L.	Aug 15/10	Gillnet	33	CC	30							
Moberly L.	Aug 15/10	Gillnet	34	LSU	431							
Moberly L.	Aug 15/10	Gillnet	35	LSU	294							
Moberly L.	Aug 15/10	Gillnet	36	CSU	302							
Moberly L.	Aug 15/10	Gillnet	37	CSU	455							
Moberly L.	Aug 15/10	Gillnet	38	CSU	495							
Gwillim L.	Aug 16/22	Trawl	1	LW	72	4.15	.	J	1	1		
Gwillim L.	Aug 16/22	Trawl	2	LW	263	195.00	M	A	2	6		
Gwillim L.	Aug 17/13	Gillnet	1	NP	680	2700.00	M	A				
Gwillim L.	Aug 17/13	Gillnet	2	LW	464	1125.00	M	A	1	10		
Gwillim L.	Aug 17/13	Gillnet	3	LW	240	160.00	M	A	2	4		
Gwillim L.	Aug 17/13	Gillnet	4	LW	304	290.00	F	A	3	5		
Gwillim L.	Aug 17/13	Gillnet	5	LW	260	195.00	M	A	4	5		
Gwillim L.	Aug 17/13	Gillnet	6	LW	258	190.00	F	A	5	5		
Gwillim L.	Aug 17/13	Gillnet	7	LW	263	225.00	F	A	6	5		
Gwillim L.	Aug 17/13	Gillnet	8	LW	256	275.00	F	A	7	5		
Gwillim L.	Aug 17/13	Gillnet	9	LW	254	225.00	F	A	8	5		
Gwillim L.	Aug 17/13	Gillnet	10	LW	265	190.00	M	A	9	5		
Gwillim L.	Aug 17/13	Gillnet	11	LW	259	195.00	F	A	10	6		
Gwillim L.	Aug 17/13	Gillnet	12	LW	279	200.00	F	A	11	6		
Gwillim L.	Aug 17/13	Gillnet	13	LW	305	225.00	F	A	12	6		
Gwillim L.	Aug 17/13	Gillnet	14	LW	298	250.00	F	A	13	6		
Gwillim L.	Aug 17/13	Gillnet	15	LW	246	185.00	M	A	14	5		
Gwillim L.	Aug 17/13	Gillnet	16	LW	216	105.00	M	J	15	3		
Gwillim L.	Aug 17/13	Gillnet	17	LW	259	170.00	F	A	16	5		
Gwillim L.	Aug 17/13	Gillnet	18	LW	278	230.00	M	A	17	5		
Gwillim L.	Aug 17/13	Gillnet	19	LW	250	163.00	F	A	18	5		
Gwillim L.	Aug 17/13	Gillnet	20	LW	249	180.00	M	A	19	3		
Gwillim L.	Aug 17/13	Gillnet	21	LW	151	35.00		J	20	2		
Gwillim L.	Aug 17/13	Gillnet	22	LW	170	49.80		J	21	4		
Gwillim L.	Aug 17/13	Gillnet	23	LW	132	20.10		J	22	1		
Gwillim L.	Aug 17/13	Gillnet	24	LW	113	12.90		J	23	1		
Gwillim L.	Aug 17/13	Gillnet	25	GR	276	235.00	F	A	1	3	3	
Gwillim L.	Aug 17/13	Gillnet	26	GR	294	255.00	F	A	2	3		

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Gwillim L.	Aug 17/13	Gillnet	27	LNS	109	13.40						
Gwillim L.	Aug 17/13	Gillnet	28	LNS	292	350.00						
Gwillim L.	Aug 17/13	Gillnet	29	RB	169	45.40			1	2		
Gwillim L.	Aug 17/13	Gillnet	30	SU	400							
Smokehous	Aug 17/17	Shocker	1	CC								
Smokehous	Aug 17/17	Shocker	2	CC								
Smokehous	Aug 17/17	Shocker	3	CC								
Smokehous	Aug 17/17	Shocker	4	CC								
Smokehous	Aug 17/17	Shocker	5	CC								
Smokehous	Aug 17/17	Shocker	6	CC								
Smokehous	Aug 17/17	Shocker	7	CC								
Smokehous	Aug 17/17	Shocker	8	CC								
Smokehous	Aug 17/17	Shocker	9	CC								
Smokehous	Aug 17/17	Shocker	10	CC								
Smokehous	Aug 17/17	Shocker	11	CC								
Smokehous	Aug 17/17	Shocker	12	CC								
Smokehous	Aug 17/17	Shocker	13	CC								
Smokehous	Aug 17/17	Shocker	14	CC								
Smokehous	Aug 17/17	Shocker	15	CC								
Smokehous	Aug 17/17	Shocker	16	CC								
Smokehous	Aug 17/17	Shocker	17	CC								
Smokehous	Aug 17/17	Shocker	18	CC								
Smokehous	Aug 17/17	Shocker	19	CC								
Smokehous	Aug 17/17	Shocker	20	CC								
Smokehous	Aug 17/17	Shocker	21	CC								
Smokehous	Aug 17/17	Shocker	22	CC								
Smokehous	Aug 17/17	Shocker	23	CC								
Smokehous	Aug 17/17	Shocker	24	CC								
Smokehous	Aug 17/17	Shocker	25	CC								
Smokehous	Aug 17/17	Shocker	26	CC								
Smokehous	Aug 17/17	Shocker	27	CC								
Smokehous	Aug 17/17	Shocker	28	CC								
Smokehous	Aug 17/17	Shocker	29	CC								
Smokehous	Aug 17/17	Shocker	30	CC								
Smokehous	Aug 17/17	Shocker	31	CC								
Smokehous	Aug 17/17	Shocker	32	CC								
Smokehous	Aug 17/17	Shocker	33	CC								
Smokehous	Aug 17/18	Shocker	1	RB	157				1	2		
Smokehous	Aug 17/18	Shocker	2	CC								
Smokehous	Aug 17/18	Shocker	3	CC								
Smokehous	Aug 17/18	Shocker	4	CC								
Smokehous	Aug 17/18	Shocker	5	CC								
Smokehous	Aug 17/18	Shocker	6	CC								
Smokehous	Aug 17/18	Shocker	7	CC								
Smokehous	Aug 17/18	Shocker	8	CC								
Smokehous	Aug 17/18	Shocker	9	CC								
Smokehous	Aug 17/18	Shocker	10	CC								
Smokehous	Aug 17/18	Shocker	11	CC								
Smokehous	Aug 17/18	Shocker	12	CC								
Smokehous	Aug 17/18	Shocker	1	BB								
Smokehous	Aug 17/18	Shocker	2	LSU								
Smokehous	Aug 17/18	Shocker	3	CC								
Smokehous	Aug 17/18	Shocker	4	CC								
Smokehous	Aug 17/18	Shocker	5	CC								
Smokehous	Aug 17/18	Shocker	6	CC								
Smokehous	Aug 17/18	Shocker	7	CC								

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Smokehous	Aug 17/18	Shocker	8	CC								
Smokehous	Aug 17/18	Shocker	9	CC								
Smokehous	Aug 17/18	Shocker	10	CC								
Smokehous	Aug 17/18	Shocker	11	CC								
Smokehous	Aug 17/18	Shocker	12	CC								
Smokehous	Aug 17/18	Shocker	13	CC								
Smokehous	Aug 17/18	Shocker	14	CC								
Smokehous	Aug 17/18	Shocker	15	CC								
Smokehous	Aug 17/18	Shocker	16	CC								
Smokehous	Aug 17/18	Shocker	17	CC								
Smokehous	Aug 17/18	Shocker	18	CC								
Smokehous	Aug 17/18	Shocker	19	CC								
Smokehous	Aug 17/18	Shocker	20	CC								
Smokehous	Aug 17/18	Shocker	21	CC								
Smokehous	Aug 17/18	Shocker	22	CC								
Smokehous	Aug 17/18	Shocker	23	CC								
Smokehous	Aug 17/18	Shocker	24	CC								
Smokehous	Aug 17/18	Shocker	25	CC								
Smokehous	Aug 17/18	Shocker	26	CC								
Smokehous	Aug 17/18	Shocker	27	CC								
Smokehous	Aug 17/18	Shocker	28	CC								
Smokehous	Aug 17/18	Shocker	29	CC								
Smokehous	Aug 17/18	Shocker	30	CC								
Smokehous	Aug 17/18	Shocker	31	CC								
Smokehous	Aug 17/18	Shocker	32	CC								
Gwillim L.	Aug 17/20	Gillnet	1	LT	916	10250.00	M	A	1	9	25	
Gwillim L.	Aug 17/20	Gillnet	2	LW	249	185.00	M	A	1	6		
Gwillim L.	Aug 17/21	Seine	1	NP	598	1525.00	M	A				
Gwillim L.	Aug 17/21	Seine	2	WSU	210	105.00						
Gwillim L.	Aug 17/21	Seine	3	WSU	225	140.00						
Gwillim L.	Aug 17/21	Seine	4	SU	27	0.50						
Gwillim L.	Aug 17/21	Seine	5	SU	34	0.60						
Gwillim L.	Aug 17/21	Seine	6	SU	33	0.55						
Gwillim L.	Aug 17/21	Seine	7	SU	33	0.55						
Gwillim L.	Aug 17/21	Seine	8	SU	33	0.45						
Gwillim L.	Aug 17/21	Seine	9	SU	32	0.55						
Gwillim L.	Aug 17/21	Seine	10	SU	30	0.40						
Gwillim L.	Aug 17/21	Seine	11	SU	32	0.50						
Gwillim L.	Aug 17/21	Seine	12	SU	31	0.45						
Gwillim L.	Aug 17/21	Seine	13	SU	23	0.30						
Gwillim L.	Aug 17/21	Seine	14	SU	38	0.70						
Gwillim L.	Aug 17/21	Seine	15	SU	33	0.45						
Gwillim L.	Aug 17/21	Seine	16	SU	33	0.40						
Gwillim L.	Aug 17/21	Seine	17	SU	37	0.65						
Gwillim L.	Aug 17/21	Seine	18	SU	33	0.40						
Gwillim L.	Aug 17/21	Seine	19	SU	35	0.55						
Gwillim L.	Aug 17/21	Seine	20	SU	35	0.55						
Gwillim L.	Aug 17/21	Seine	21	SU	34	0.45						
Gwillim L.	Aug 17/21	Seine	22	SU	37	0.70						
Gwillim L.	Aug 17/21	Seine	23	SU	41	0.85						
Gwillim L.	Aug 17/21	Seine	24	SU	36	0.55						
Gwillim L.	Aug 17/21	Seine	25	SU	34	0.50						
Gwillim L.	Aug 17/21	Seine	26	SU	37	0.60						
Gwillim L.	Aug 17/21	Seine	27	SU	36	0.60						
Gwillim L.	Aug 17/21	Seine	28	SU	34	0.50						
Gwillim L.	Aug 17/21	Seine	29	SU	37	0.60						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale		Otolith Age	Gonad Wt (g)
									No.	Age		
Gwillim L.	Aug 17/21	Seine	30	SU	36	0.60						
Gwillim L.	Aug 17/21	Seine	31	SU	38	0.60						
Gwillim L.	Aug 17/21	Seine	32	SU	34	0.50						
Gwillim L.	Aug 17/21	Seine	33	SU	33	0.40						
Gwillim L.	Aug 17/21	Seine	34	SU	36	0.55						
Gwillim L.	Aug 17/21	Seine	35	SU	33	0.50						
Gwillim L.	Aug 17/21	Seine	36	SU	35	0.55						
Gwillim L.	Aug 17/21	Seine	37	SU	36	0.60						
Gwillim L.	Aug 17/21	Seine	38	SU	34	0.35						
Gwillim L.	Aug 17/21	Seine	39	SU	28	0.35						
Gwillim L.	Aug 17/21	Seine	40	SU	34	0.50						
Gwillim L.	Aug 17/21	Seine	41	SU	30	0.25						
Gwillim L.	Aug 17/21	Seine	42	SU	33	0.45						
Gwillim L.	Aug 17/21	Seine	43	SU	30	0.35						
Gwillim L.	Aug 17/21	Seine	44	SU								
Gwillim L.	Aug 17/21	Seine	45	SU								
Gwillim L.	Aug 17/21	Seine	46	SU								
Gwillim L.	Aug 17/21	Seine	47	SU								
Gwillim L.	Aug 17/21	Seine	48	SU								
Gwillim L.	Aug 17/21	Seine	49	SU								
Gwillim L.	Aug 17/21	Seine	50	SU								
Gwillim L.	Aug 17/21	Seine	51	SU								
Gwillim L.	Aug 17/21	Seine	52	SU								
Gwillim L.	Aug 17/21	Seine	53	SU								
Gwillim L.	Aug 17/21	Seine	54	SU								
Gwillim L.	Aug 17/21	Seine	55	SU								
Gwillim L.	Aug 17/21	Seine	56	SU								
Gwillim L.	Aug 17/21	Seine	57	SU								
Gwillim L.	Aug 17/21	Seine	58	SU								
Gwillim L.	Aug 17/21	Seine	59	SU								
Gwillim L.	Aug 17/21	Seine	60	SU								
Gwillim L.	Aug 17/21	Seine	61	SU								
Gwillim L.	Aug 17/21	Seine	62	SU								
Gwillim L.	Aug 17/21	Seine	63	SU								
Gwillim L.	Aug 17/21	Seine	64	SU								
Gwillim L.	Aug 17/21	Seine	65	SU								
Gwillim L.	Aug 17/21	Seine	66	SU								
Gwillim L.	Aug 17/21	Seine	67	SU								
Gwillim L.	Aug 17/21	Seine	68	SU								
Gwillim L.	Aug 17/21	Seine	69	SU								
Gwillim L.	Aug 17/21	Seine	70	SU								
Gwillim L.	Aug 17/21	Seine	71	SU								
Gwillim L.	Aug 17/21	Seine	72	SU								
Gwillim L.	Aug 17/21	Seine	73	SU								
Gwillim L.	Aug 17/21	Seine	74	SU								
Gwillim L.	Aug 17/21	Seine	75	SU								
Gwillim L.	Aug 17/21	Seine	76	SU								
Gwillim L.	Aug 17/21	Seine	77	SU								
Gwillim L.	Aug 17/21	Seine	78	SU								
Gwillim L.	Aug 17/21	Seine	79	SU								
Gwillim L.	Aug 17/21	Seine	80	SU								
Gwillim L.	Aug 17/21	Seine	81	SU								
Gwillim L.	Aug 17/21	Seine	82	SU								
Gwillim L.	Aug 17/21	Seine	83	SU								
Gwillim L.	Aug 17/21	Seine	84	SU								
Gwillim L.	Aug 17/21	Seine	85	SU								

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Gwillim L.	Aug 17/21	Seine	86	SU								
Gwillim L.	Aug 17/21	Seine	87	SU								
Gwillim L.	Aug 17/21	Seine	88	SU								
Gwillim L.	Aug 17/21	Seine	89	SU								
Gwillim L.	Aug 17/21	Seine	90	SU								
Gwillim L.	Aug 17/21	Seine	91	SU								
Gwillim L.	Aug 17/21	Seine	92	SU								
Gwillim L.	Aug 17/21	Seine	93	SU								
Gwillim L.	Aug 17/21	Seine	94	SU								
Gwillim L.	Aug 17/21	Seine	95	SU								
Gwillim L.	Aug 17/21	Seine	96	SU								
Gwillim L.	Aug 17/21	Seine	97	SU								
Gwillim L.	Aug 17/21	Seine	98	SU								
Gwillim L.	Aug 17/21	Seine	99	SU								
Gwillim L.	Aug 17/21	Seine	100	SU								
Gwillim L.	Aug 17/21	Seine	101	SU								
Gwillim L.	Aug 17/21	Seine	102	SU								
Gwillim L.	Aug 17/21	Seine	103	SU								
Gwillim L.	Aug 17/21	Seine	104	SU								
Gwillim L.	Aug 17/21	Seine	105	SU								
Gwillim L.	Aug 17/21	Seine	106	SU								
Gwillim L.	Aug 17/21	Seine	107	SU								
Gwillim L.	Aug 17/21	Seine	108	SU								
Gwillim L.	Aug 17/21	Seine	109	SU								
Gwillim L.	Aug 17/21	Seine	110	SU								
Gwillim L.	Aug 17/21	Seine	111	SU								
Gwillim L.	Aug 17/21	Seine	112	SU								
Gwillim L.	Aug 17/21	Seine	113	SU								
Gwillim L.	Aug 17/21	Seine	114	SU								
Gwillim L.	Aug 17/21	Seine	115	SU								
Gwillim L.	Aug 17/21	Seine	116	WSU	79	5.70		J				
Gwillim L.	Aug 17/21	Seine	117	BB	41	0.55						
Gwillim L.	Aug 17/21	Seine	118	BB	43	0.70		J				
Gwillim L.	Aug 17/21	Seine	119	BB	136	16.50		J				
Gwillim L.	Aug 17/21	Seine	120	BB	133	15.80		J			9	
Gwillim L.	Aug 17/21	Seine	121	BB	128	10.00		J				
Gwillim L.	Aug 17/21	Seine	122	CCG	51	1.80						
Gwillim L.	Aug 17/21	Seine	123	CCG	51	1.85						
Gwillim L.	Aug 17/21	Seine	124	CCG	52	1.85						
Gwillim L.	Aug 17/21	Seine	125	CCG	56	2.50						
Gwillim L.	Aug 17/21	Seine	126	CCG	48	1.35						
Gwillim L.	Aug 17/21	Seine	127	CCG	54	2.00						
Gwillim L.	Aug 17/21	Seine	128	CCG	40	0.90						
Gwillim L.	Aug 17/21	Seine	129	CCG	41	0.90						
Gwillim L.	Aug 17/21	Seine	130	CCG	45	1.20						
Gwillim L.	Aug 17/21	Seine	131	CCG	40	0.80						
Gwillim L.	Aug 17/22	Seine	1	SU	34	0.45		J				
Gwillim L.	Aug 17/22	Seine	2	LSU	62	2.45						
Gwillim L.	Aug 17/22	Seine	3	CCG	47	0.45						
Gwillim L.	Aug 17/22	Seine	4	BB	102	5.65		J				
Gwillim L.	Aug 18/11	Gillnet	1	LW	314	380.00	F	A	1	6		
Gwillim L.	Aug 18/11	Gillnet	2	LW	262	210.00	M	A	2	5		
Gwillim L.	Aug 18/11	Gillnet	3	LW	345	440.00	F	A	3	7		
Gwillim L.	Aug 18/11	Gillnet	4	LW	284	225.00	M	A	4	5		
Gwillim L.	Aug 18/11	Gillnet	5	LW	283	230.00	M	A	5	6		
Gwillim L.	Aug 18/11	Gillnet	6	LW	269	200.00	F	A	6	5		

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Gwillim L.	Aug 18/11	Gillnet	7	LW	266	195.00	F	A	7	5		.
Gwillim L.	Aug 18/11	Gillnet	8	LW	263	205.00	F	A	8	6		.
Gwillim L.	Aug 18/11	Gillnet	9	LW	226	110.00	M	A	9	3		.
Gwillim L.	Aug 18/11	Gillnet	10	LW	275	250.00	M	A	10	6		.
Gwillim L.	Aug 18/11	Gillnet	11	LNS	439							
Gwillim L.	Aug 18/11	Gillnet	12	LNS	295							
Gwillim L.	Aug 18/11	Gillnet	13	LNS	342							
Gwillim L.	Aug 18/11	Gillnet	14	LSS	466							
Gwillim L.	Aug 18/11	Gillnet	15	LSS	464							
Moberly L.	Aug 19/09	Gillnet	1	NP	523	950.00	F	A	.	.		.
Moberly L.	Aug 19/09	Gillnet	2	LW	279	290.00	M	A	1	6		.
Moberly L.	Aug 19/09	Gillnet	3	LW	313	390.00	M	A	2	6		.
Moberly L.	Aug 19/09	Gillnet	4	LW	322	530.00	M	A	3	8		.
Moberly L.	Aug 19/09	Gillnet	5	LW	252	190.00	.	.	4	4		.
Moberly L.	Aug 19/09	Gillnet	6	LW	288	280.00	.	.	5	5		.
Moberly L.	Aug 19/09	Gillnet	7	LW	297	310.00	.	.	6	6		.
Moberly L.	Aug 19/09	Gillnet	8	LW	302	285.00	.	.	7	5		.
Moberly L.	Aug 19/09	Gillnet	9	LW	306	345.00	.	.	8	4		.
Moberly L.	Aug 19/09	Gillnet	10	LW	157	35.90	.	.	9	2		.
Moberly L.	Aug 19/09	Gillnet	11	LW	159	40.90	.	.	10	2		.
Moberly L.	Aug 19/09	Gillnet	12	LW	166	50.50	.	.	11	2		.
Moberly L.	Aug 19/09	Gillnet	13	LW	201	33.40	.	.	12	3		.
Moberly L.	Aug 19/09	Gillnet	14	LW	149	34.20	.	.	13	2		.
Moberly L.	Aug 19/09	Gillnet	15	LW	159	42.90	.	.	.	2		.
Moberly L.	Aug 19/09	Gillnet	16	LW	154	37.50	.	.	14	2		.
Moberly L.	Aug 19/09	Gillnet	17	LW	156	41.50	.	.	15	2		.
Moberly L.	Aug 19/09	Gillnet	18	LW	152	35.70	.	.	16	2		.
Moberly L.	Aug 19/09	Gillnet	19	LW	154	35.10	.	.	17	2		.
Moberly L.	Aug 19/09	Gillnet	20	LW	145	30.90	.	.	18	2		.
Moberly L.	Aug 19/09	Gillnet	21	BB	245	100.00	.	.	.	.	2	.
Moberly L.	Aug 19/09	Gillnet	22	BB	247	95.00	.	.	.	.		.
Moberly L.	Aug 19/09	Gillnet	23	LSU	485							
Moberly L.	Aug 19/16	Gillnet	1	LW	294	275.00	.	.	1	.		.
Moberly L.	Aug 19/16	Gillnet	2	LW	313	365.00	.	.	2	5		.
Moberly L.	Aug 19/16	Gillnet	3	LW	346	440.00	.	.	3	7		.
Moberly L.	Aug 19/16	Gillnet	4	LW	292	280.00	.	.	4	6		.
Moberly L.	Aug 19/16	Gillnet	5	LW	286	280.00	.	.	5	5		.
Moberly L.	Aug 19/16	Gillnet	6	LW	305	315.00	.	.	6	6		.
Moberly L.	Aug 19/16	Gillnet	7	LW	325	450.00	.	.	7	7		.
Moberly L.	Aug 19/16	Gillnet	8	LW	249	180.00	.	.	8	3		.
Moberly L.	Aug 19/16	Gillnet	9	LW	294	315.00	.	.	9	5		.
Moberly L.	Aug 19/16	Gillnet	10	LW	290	290.00	.	.	10	6		.
Moberly L.	Aug 19/16	Gillnet	11	LW	312	435.00	.	.	11	7		.
Moberly L.	Aug 19/16	Gillnet	12	LW	305	310.00	.	.	12	6		.
Moberly L.	Aug 19/16	Gillnet	13	LW	254	200.00	.	.	13	3		.
Moberly L.	Aug 19/16	Gillnet	14	LW	174	54.10	.	.	14	2		.
Moberly L.	Aug 19/16	Gillnet	15	LW	154	34.40	.	.	15	2		.
Moberly L.	Aug 19/16	Gillnet	16	LW	172	49.05	.	.	.	.		.
Moberly L.	Aug 19/16	Gillnet	17	LW	164	46.75	.	.	16	2		.
Moberly L.	Aug 19/16	Gillnet	18	LW	155	45.45	.	.	17	2		.
Moberly L.	Aug 19/16	Gillnet	19	LW	155	34.05	.	.	.	.		.
Moberly L.	Aug 19/16	Gillnet	20	LW	173	54.75	.	.	18	.		.
Moberly L.	Aug 19/16	Gillnet	21	NP	437	600.00	.	.	.	.		.
Moberly L.	Aug 19/21	Seine	1	SU	45	1						
Moberly L.	Aug 19/21	Seine	2	SU	47	1.20						
Moberly L.	Aug 19/21	Seine	3	SU	44	0.45						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 19/21	Seine	4	SU	50	1.20						
Moberly L.	Aug 19/21	Seine	5	SU	46	0.90						
Moberly L.	Aug 19/21	Seine	6	SU	48	1.05						
Moberly L.	Aug 19/21	Seine	7	SU	47	1.00						
Moberly L.	Aug 19/21	Seine	8	SU	34	0.50						
Moberly L.	Aug 19/21	Seine	9	SU	33	0.45						
Moberly L.	Aug 19/21	Seine	10	CCG	42	0.75						
Moberly L.	Aug 19/21	Seine	11	CCG	39	0.60						
Moberly L.	Aug 19/21	Seine	12	CCG	40	0.70						
Moberly L.	Aug 19/21	Seine	13	CCG	41	0.75						
Moberly L.	Aug 19/21	Seine	14	CCG	46	0.80						
Moberly L.	Aug 19/21	Seine	15	CCG	39	0.65						
Moberly L.	Aug 19/21	Seine	16	CCG	44	0.80						
Moberly L.	Aug 19/21	Seine	17	CCG	41	0.65						
Moberly L.	Aug 19/21	Seine	18	CCG	43	0.75						
Moberly L.	Aug 19/21	Seine	19	CCG	40	0.65						
Moberly L.	Aug 19/21	Seine	20	CCG	41	0.80						
Moberly L.	Aug 19/21	Seine	21	CCG	52	1.25						
Moberly L.	Aug 19/21	Seine	22	CCG	45	0.80						
Moberly L.	Aug 19/21	Seine	23	NP	208	54.65		J				
Moberly L.	Aug 19/21	Seine	1	NP	482	650.00	F	A				
Moberly L.	Aug 19/21	Seine	2	TP	45	1.20						
Moberly L.	Aug 19/21	Seine	3	TP	32	0.50						
Moberly L.	Aug 19/21	Seine	4	TP	26	0.25						
Moberly L.	Aug 19/21	Seine	5	BB	63	1.55						
Moberly L.	Aug 19/21	Seine	6	CCG	48	1.75						
Moberly L.	Aug 19/21	Seine	7	CCG	43	0.85						
Moberly L.	Aug 19/21	Seine	8	CCG	42	0.80						
Moberly L.	Aug 19/21	Seine	9	CCG	45	0.95						
Moberly L.	Aug 19/21	Seine	10	CCG	41	0.85						
Moberly L.	Aug 19/21	Seine	11	CCG	39	0.75						
Moberly L.	Aug 19/21	Seine	12	CCG	35	0.50						
Moberly L.	Aug 19/21	Seine	13	CCG	38	0.70						
Moberly L.	Aug 19/21	Seine	14	CCG	44	0.85						
Moberly L.	Aug 19/21	Seine	15	CCG	39	0.65						
Moberly L.	Aug 19/21	Seine	16	CCG	39	0.65						
Moberly L.	Aug 19/21	Seine	17	CCG	46	1.05						
Moberly L.	Aug 19/21	Seine	18	CCG	41	0.75						
Moberly L.	Aug 19/21	Seine	19	CCG	40	0.80						
Moberly L.	Aug 19/21	Seine	20	CCG	43	0.85						
Moberly L.	Aug 19/21	Seine	21	CCG	38	0.60						
Moberly L.	Aug 19/21	Seine	22	CCG	57	1.65						
Moberly L.	Aug 19/21	Seine	23	CCG	48	1.28						
Moberly L.	Aug 19/21	Seine	24	CCG	41	1.05						
Moberly L.	Aug 19/21	Seine	25	CCG	42	0.90						
Moberly L.	Aug 19/21	Seine	26	CCG	42	0.95						
Moberly L.	Aug 19/21	Seine	27	CCG	40	0.80						
Moberly L.	Aug 19/21	Seine	28	CCG	38	0.60						
Moberly L.	Aug 19/21	Seine	29	CCG	40	0.70						
Moberly L.	Aug 19/21	Seine	30	CCG	35	0.45						
Moberly L.	Aug 19/21	Seine	31	CCG	40	0.70						
Moberly L.	Aug 19/21	Seine	32	CCG	43	0.85						
Moberly L.	Aug 19/21	Seine	33	CCG	40	0.65						
Moberly L.	Aug 19/21	Seine	34	CCG	40	0.70						
Moberly L.	Aug 19/21	Seine	35	CCG	39	0.65						
Moberly L.	Aug 19/21	Seine	36	CCG	45	1.00						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 19/21	Seine	37	SU	45	1.20						
Moberly L.	Aug 19/21	Seine	38	SU	38	0.65						
Moberly L.	Aug 19/21	Seine	39	SU	35	0.60						
Moberly L.	Aug 19/21	Seine	40	SU	45	1.20						
Moberly L.	Aug 19/21	Seine	41	SU	43	0.75						
Moberly L.	Aug 19/21	Seine	42	SU	34	0.50						
Moberly L.	Aug 19/21	Seine	43	SU	34	0.35						
Moberly L.	Aug 19/21	Seine	44	SU	47	1.30						
Moberly L.	Aug 19/21	Seine	45	SU	45	1.10						
Moberly L.	Aug 19/21	Seine	46	SU	37	0.65						
Moberly L.	Aug 19/21	Seine	47	SU	38	0.75						
Moberly L.	Aug 19/21	Seine	48	SU	33	0.50						
Moberly L.	Aug 19/21	Seine	49	SU	34	0.50						
Moberly L.	Aug 19/21	Seine	50	SU	35	0.55						
Moberly L.	Aug 19/21	Seine	51	SU	44	1.05						
Moberly L.	Aug 19/21	Seine	52	SU	40	0.85						
Moberly L.	Aug 19/21	Seine	53	SU	44	0.75						
Moberly L.	Aug 19/21	Seine	54	SU	36	0.65						
Moberly L.	Aug 19/21	Seine	55	SU	34	0.55						
Moberly L.	Aug 19/21	Seine	56	SU	47	1.45						
Moberly L.	Aug 19/21	Seine	57	SU	47	1.30						
Moberly L.	Aug 19/21	Seine	58	SU	42	0.80						
Moberly L.	Aug 19/21	Seine	59	SU	46	1.20						
Moberly L.	Aug 19/21	Seine	60	SU	33	0.45						
Moberly L.	Aug 19/21	Seine	61	SU	38	0.75						
Moberly L.	Aug 19/21	Seine	62	SU	47	1.35						
Moberly L.	Aug 19/21	Seine	63	SU	35	0.50						
Moberly L.	Aug 19/21	Seine	64	SU	39	0.65						
Moberly L.	Aug 19/21	Seine	65	SU	37	0.65						
Moberly L.	Aug 19/21	Seine	66	SU	37	0.65						
Moberly L.	Aug 19/21	Seine	67	SU	37	0.6						
Moberly L.	Aug 19/21	Seine	68	SU	44	1.1						
Moberly L.	Aug 19/21	Seine	69	SU	42	0.85						
Moberly L.	Aug 19/21	Seine	70	SU	44	1.1						
Moberly L.	Aug 19/21	Seine	71	SU	38	0.75						
Moberly L.	Aug 19/21	Seine	72	SU	43	0.75						
Moberly L.	Aug 19/21	Seine	73	SU	33	0.5						
Moberly L.	Aug 19/21	Seine	74	SU								
Moberly L.	Aug 19/21	Seine	75	SU								
Moberly L.	Aug 19/21	Seine	76	CCG	38	0.65						
Moberly L.	Aug 19/22	Seine	1	SU	36	0.65		J				
Moberly L.	Aug 19/22	Seine	2	SU	39	0.60		J				
Moberly L.	Aug 19/22	Seine	3	SU	40	0.75		J				
Moberly L.	Aug 19/22	Seine	4	SU	36	0.55		J				
Moberly L.	Aug 19/22	Seine	5	BB	71	1.75		J				
Moberly L.	Aug 19/22	Seine	6	TP	22	0.30						
Moberly L.	Aug 19/22	Seine	7	TP	24	0.20						
Moberly L.	Aug 19/22	Seine	8	TP	25	0.20						
Moberly L.	Aug 19/22	Seine	9	TP	26	0.25						
Moberly L.	Aug 19/22	Seine	10	TP	28	0.25						
Moberly L.	Aug 19/22	Seine	11	TP	26	0.25						
Moberly L.	Aug 19/22	Seine	12	TP	24	0.20						
Moberly L.	Aug 19/22	Seine	13	TP	28	0.30						
Moberly L.	Aug 19/22	Seine	14	TP	26	0.20						
Moberly L.	Aug 19/22	Seine	15	TP	28	0.30						
Moberly L.	Aug 19/22	Seine	16	TP	25	0.20						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 19/22	Seine	17	TP	45	0.45						
Moberly L.	Aug 19/22	Seine	18	TP	36	0.60						
Moberly L.	Aug 19/22	Seine	19	TP	42	0.95						
Moberly L.	Aug 19/22	Seine	20	TP	56	1.70						
Moberly L.	Aug 19/22	Seine	21	TP	27	0.25						
Moberly L.	Aug 19/22	Seine	22	CCG	62	1.90						
Moberly L.	Aug 19/22	Seine	23	CCG	70	3.35						
Moberly L.	Aug 19/22	Seine	24	CCG	63	2.35						
Moberly L.	Aug 19/22	Seine	25	CCG	42	0.65						
Moberly L.	Aug 19/22	Seine	26	CCG	61	2.05						
Moberly L.	Aug 19/22	Seine	27	CCG	43	0.65						
Moberly L.	Aug 19/22	Seine	28	CCG	43	0.70						
Moberly L.	Aug 19/22	Seine	29	CCG	39	0.45						
Moberly L.	Aug 19/22	Seine	30	CCG	45	0.85						
Moberly L.	Aug 19/22	Seine	31	CCG	41	0.60						
Moberly L.	Aug 19/22	Seine	32	CCG	44	0.75						
Moberly L.	Aug 19/22	Seine	33	CCG	42	0.75						
Moberly L.	Aug 19/22	Seine	34	CCG	45	0.80						
Moberly L.	Aug 19/22	Seine	35	CCG	38	0.45						
Moberly L.	Aug 19/22	Seine	36	CCG	41	0.60						
Moberly L.	Aug 19/22	Seine	37	CCG	42	0.65						
Moberly L.	Aug 19/22	Seine	38	CCG	38	0.50						
Moberly L.	Aug 19/22	Seine	39	CCG	53	1.20						
Moberly L.	Aug 19/22	Seine	40	CCG	48	0.80						
Moberly L.	Aug 19/22	Seine	1	CCG	42	0.80						
Moberly L.	Aug 19/22	Seine	2	SU	42	0.90						
Moberly L.	Aug 19/22	Seine	3	SU	44	0.85						
Moberly L.	Aug 19/22	Seine	4	SU	21	0.25						
Moberly L.	Aug 19/22	Seine	5	BB	62	1.60						
Moberly L.	Aug 19/22	Seine	6	BB	70	2.40						
Moberly L.	Aug 19/22	Seine	7	BB	57	1.40						
Moberly L.	Aug 19/22	Seine	8	BB	72	2.45						
Moberly L.	Aug 19/22	Seine	9	BB	65	1.70						
Moberly L.	Aug 19/22	Seine	10	BB	64	1.80						
Moberly L.	Aug 19/22	Seine	11	BB	67	1.65						
Moberly L.	Aug 19/22	Seine	12	BP	153	22.55		J				
Moberly L.	Aug 19/22	Seine	13	NP	165	29.25		J				
Moberly L.	Aug 19/22	Seine	14	NP	128	15.70		J				
Moberly L.	Aug 19/22	Seine	15	NP	151	26.60		J				
Moberly L.	Aug 19/23	Seine	1	CCG	55	2.00		J				
Moberly L.	Aug 19/23	Seine	2	BB	60	1.65		J				
Moberly L.	Aug 19/23	Seine	3	BB	64	2.00		J				
Moberly L.	Aug 19/23	Seine	4	BB	63	1.75		J				
Moberly L.	Aug 19/23	Seine	5	BB	73	3.05		J				
Moberly L.	Aug 19/23	Seine	6	BB	58	1.30		J				
Moberly L.	Aug 19/23	Seine	7	BB	71	3.20		J				
Moberly L.	Aug 19/23	Seine	8	BB	80	3.90		J				
Moberly L.	Aug 19/23	Seine	9	NP	135	17.60		J				
Moberly L.	Aug 19/23	Seine	10	NP	165	34.50		J				
Moberly L.	Aug 19/23	Seine	11	NP	159	26.45		J				
Moberly L.	Aug 19/23	Seine	12	NP	118	11.50		J				
Moberly L.	Aug 19/23	Seine	13	NP	156	27.80		J				
Moberly L.	Aug 19/23	Seine	14	NP	138	14.35		J				
Moberly L.	Aug 20/09	Gillnet	1	LW								
Moberly L.	Aug 20/09	Gillnet	2	LW								
Moberly L.	Aug 20/09	Gillnet	3	LW								

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Aug 20/09	Gillnet	4	LW								
Moberly L.	Aug 20/09	Gillnet	5	LW								
Moberly L.	Aug 20/09	Gillnet	6	LW								
Moberly L.	Aug 20/09	Gillnet	7	LW								
Moberly L.	Aug 20/09	Gillnet	8	LW								
Moberly L.	Aug 20/09	Gillnet	9	LW								
Moberly L.	Aug 20/09	Gillnet	10	LW								
Moberly L.	Aug 20/09	Gillnet	11	LW								
Moberly L.	Aug 20/09	Gillnet	12	LW								
Moberly L.	Aug 20/09	Gillnet	13	LW								
Moberly L.	Aug 20/09	Gillnet	14	LW								
Moberly L.	Aug 20/09	Gillnet	15	LW								
Moberly L.	Aug 20/09	Gillnet	16	LW								
Moberly L.	Aug 20/09	Gillnet	17	LW								
Moberly L.	Aug 20/09	Gillnet	18	LW								
Moberly L.	Aug 20/09	Gillnet	19	LW								
Moberly L.	Aug 20/09	Gillnet	20	LW								
Moberly L.	Aug 20/09	Gillnet	21	LW								
Moberly L.	Aug 20/09	Gillnet	22	LW								
Moberly L.	Aug 20/09	Gillnet	23	LW								
Moberly L.	Aug 20/09	Gillnet	24	LW								
Moberly L.	Aug 20/09	Gillnet	25	LW								
Moberly L.	Aug 20/09	Gillnet	26	LW								
Moberly L.	Aug 20/09	Gillnet	27	LW								
Moberly L.	Aug 20/09	Gillnet	28	LW								
Moberly L.	Aug 20/09	Gillnet	29	LW								
Moberly L.	Aug 20/09	Gillnet	30	LW								
Moberly L.	Aug 20/09	Gillnet	31	LW								
Moberly L.	Aug 20/09	Gillnet	32	LW								
Moberly L.	Aug 20/09	Gillnet	33	LW								
Moberly L.	Aug 20/09	Gillnet	34	LW								
Moberly L.	Aug 20/09	Gillnet	35	LW								
Moberly L.	Aug 20/09	Gillnet	36	LW								
Moberly L.	Aug 20/09	Gillnet	37	LW								
Moberly L.	Aug 20/09	Gillnet	38	LW								
Moberly L.	Aug 20/09	Gillnet	39	LW								
Moberly L.	Aug 20/09	Gillnet	40	LW								
Moberly L.	Aug 20/09	Gillnet	41	LW								
Moberly L.	Aug 20/09	Gillnet	42	LW								
Moberly L.	Aug 20/09	Gillnet	43	LW								
Moberly L.	Aug 20/09	Gillnet	44	LW								
Moberly L.	Aug 20/09	Gillnet	45	LW								
Moberly L.	Aug 20/09	Gillnet	46	LW								
Moberly L.	Aug 20/09	Gillnet	47	LW								
Moberly L.	Aug 20/09	Gillnet	48	LW								
Moberly L.	Aug 20/09	Gillnet	49	LSU								
Moberly L.	Aug 20/09	Gillnet	50	LSU								
Moberly L.	Aug 20/09	Gillnet	51	LSU								
Moberly L.	Aug 20/09	Gillnet	52	LSU								
Moberly L.	Aug 20/09	Gillnet	53	LT	580	2600.00	M				7	
Moberly L.	Aug 20/09	Gillnet	54	LT	432	650.00	M				6	
Moberly L.	Aug 20/09	Gillnet	55	LT	385	450.00	F				5	
Gwillim L.	Sep 26/00	Gillnet	1	LW	105	11.00	.		1	1		
Gwillim L.	Sep 26/00	Gillnet	2	LW	104	11.20	.		2	1		
Gwillim L.	Sep 26/00	Gillnet	3	LW	104	11.15	.		3	1		
Gwillim L.	Sep 26/00	Gillnet	4	LW	109	12.35	.		4	1		

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-unity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Gwillim L.	Sep 26/00	Gillnet	5	LW	97	8.85	.	.	5	1		
Gwillim L.	Sep 26/00	Gillnet	6	LW	107	12.40	.	.	6	1		
Gwillim L.	Sep 26/00	Gillnet	7	LW	107	12.05	.	.	7	1		
Gwillim L.	Sep 26/00	Gillnet	8	LW	106	11.05	.	.	8	1		
Gwillim L.	Sep 26/00	Gillnet	9	LW	105	11.70	.	.	9	1		
Gwillim L.	Sep 26/00	Gillnet	10	LW	115	15.85	.	.	10	1		
Gwillim L.	Sep 26/00	Gillnet	11	LW	106	11.35	.	.	11	1		
Gwillim L.	Sep 26/00	Gillnet	12	LW	104	11.75	.	.	12	1		
Gwillim L.	Sep 26/00	Gillnet	13	LW	101	10.40	.	.	13	1		
Gwillim L.	Sep 26/00	Gillnet	14	LW	102	10.55	.	.	14	1		
Gwillim L.	Sep 26/00	Gillnet	15	LW	103	10.40	.	.	15	1		
Gwillim L.	Sep 26/00	Gillnet	16	LW	103	11.10	.	.	16	1		
Gwillim L.	Sep 26/00	Gillnet	17	LW	109	11.35	.	.	17	1		
Gwillim L.	Sep 26/00	Gillnet	18	LW	101	11.20	.	.	18	1		
Gwillim L.	Sep 26/00	Gillnet	19	LW	110	13.65	.	.	19	1		
Gwillim L.	Sep 26/00	Gillnet	20	LW	101	10.65	.	.	20	1		
Gwillim L.	Sep 26/00	Gillnet	21	LW	116	11.30	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	22	LW	109	12.30	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	23	LW	103	11.80	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	24	LW	105	11.50	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	25	LW	100	10.00	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	26	LW	108	11.20	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	27	LW	104	10.20	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	28	LW	110	13.10	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	29	LW	108	11.85	.	.	.	.		
Gwillim L.	Sep 26/00	Gillnet	30	LW	126	19.95	.	.	30	2		
Gwillim L.	Sep 26/00	Gillnet	31	LW	151	34.00	.	.	31	2		
Gwillim L.	Sep 26/00	Gillnet	32	LW	133	21.35	.	.	32	2		
Gwillim L.	Sep 26/00	Gillnet	33	LW	139	26.95	.	.	33	2		
Gwillim L.	Sep 26/00	Gillnet	34	LW	234	145.00	.	.	34	3		
Gwillim L.	Sep 26/00	Gillnet	35	LW	222	127.00	.	.	35	3		
Gwillim L.	Sep 26/00	Gillnet	36	LW	243	190.00	.	.	36	4		
Gwillim L.	Sep 26/00	Gillnet	37	LW	580	1337.00	.	.	37	13		
Gwillim L.	Sep 26/00	Gillnet	38	DV	261	175.00	.	.	38	.	3	
Gwillim L.	Sep 26/00	Gillnet	39	DV	224	112.65	.	.	39	.	2	
Gwillim L.	Sep 26/00	Gillnet	40	BB	144	16.90	.	.	40	.	1	
Gwillim L.	Sep 26/00	Gillnet	41	LW	286	265.00	M	M	41	6		
Gwillim L.	Sep 26/00	Gillnet	42	LW	215	130.00	.	J	42	4		
Gwillim L.	Sep 26/00	Gillnet	43	LW	312	395.00	M	M	43	8		
Gwillim L.	Sep 26/00	Gillnet	44	DV	218	370.00	.	J	.	.	2	
Gwillim L.	Sep 26/00	Gillnet	45	LT	272	195.00	.	J	.	.	5	
Gwillim L.	Sep 26/00	Gillnet	46	LW	253	190.00	M	M	46	.		
Gwillim L.	Sep 26/00	Gillnet	47	LW	105	11.10	.	.	47	1		
Gwillim L.	Sep 26/00	Gillnet	48	LT	688	4800.00	F	M	48	8	15	
Gwillim L.	Sep 26/00	Gillnet	49	LT	699	4800.00	M	M	49	8	15	178.15
Gwillim L.	Sep 26/00	Gillnet	50	LT	686	4800.00	M	M	50	7	14	207.80
Gwillim L.	Sep 26/00	Gillnet	51	LT	684	4800.00	M	M	51	7	13	197.65
Gwillim L.	Sep 26/00	Gillnet	52	LT	665	4400.00	M	M	52	7	14	132.90
Gwillim L.	Sep 26/00	Gillnet	53	LT	732	6300.00	F	M	53	9	13	
Gwillim L.	Sep 26/00	Gillnet	54	LT	710	5300.00	F	M	54	8	12	
Gwillim L.	Sep 26/00	Gillnet	55	LT	689	5500.00	M	M	55	7	13	203.85
Gwillim L.	Sep 26/00	Gillnet	56	LSU	324	485.00	.	A	.	.		
Gwillim L.	Sep 26/00	Gillnet	57	LSU	446	1100.00	.	A	.	.		
Gwillim L.	Sep 26/00	Gillnet	58	LSU	391	675.00	.	A	.	.		
Gwillim L.	Sep 26/00	Gillnet	59	LSU	424	950.00	.	A	.	.		
Gwillim L.	Sep 26/00	Gillnet	60	LW	262	210.00	F	J	60	6		

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Gwillim L.	Sep 26/00	Gillnet	61	LW	286	325.00	M	M	61	6		7.55
Gwillim L.	Sep 26/00	Gillnet	62	LW	271	225.00	F	J	62	.		1.30
Gwillim L.	Sep 26/00	Gillnet	63	LW	265	250.00	F	J	63	6		1.65
Gwillim L.	Sep 26/00	Gillnet	64	LW	373	725.00	M	M	64	8		16.10
Gwillim L.	Sep 26/00	Gillnet	65	LW	288	300.00	M	M	65	6		6.00
Gwillim L.	Sep 26/00	Gillnet	66	LW	276	250.00	M	M	66	6		3.95
Gwillim L.	Sep 26/00	Gillnet	67	LW	259	225.00	F	J	67	6		10.80
Gwillim L.	Sep 26/00	Gillnet	68	LW	277	250.00	M	J	68	6		1.50
Gwillim L.	Sep 26/00	Gillnet	69	LW	282	250.00	M	J	69	6		0.65
Gwillim L.	Sep 26/00	Gillnet	70	LW	270	250.00	M	J	70	6		0.95
Gwillim L.	Sep 26/00	Gillnet	71	LW	255	200.00	F	J	71	6		1.00
Gwillim L.	Sep 26/00	Gillnet	72	LW	269	230.00	M	J	72	6		3.45
Gwillim L.	Sep 26/00	Gillnet	73	LW	164	44.20	.	J	73	2		.
Gwillim L.	Sep 26/00	Gillnet	74	LW	157	42.15	.	J	74	2		.
Gwillim L.	Sep 26/00	Gillnet	75	LW	147	31.30	.	J	75	2		.
Gwillim L.	Sep 26/00	Gillnet	76	LW	153	38.25	.	J	76	2		.
Gwillim L.	Sep 26/00	Gillnet	77	LSU	187	77.15	.	J	.	.		.
Gwillim L.	Sep 26/00	Gillnet	78	LW	151	37.70	.	J	78	2		.
Gwillim L.	Sep 26/00	Gillnet	79	LW	152	30.70	.	J	79	2		.
Gwillim L.	Sep 26/00	Gillnet	80	LSU	161	48.90	.	.	.	.		.
Gwillim L.	Sep 26/00	Gillnet	81	LW	159	45.25	.	J	81	2		.
Gwillim L.	Sep 26/00	Gillnet	82	LW	95	8.70	.	J	82	1		.
Gwillim L.	Sep 26/00	Gillnet	83	BB	223	64.45	.	J	83	.	2	.
Gwillim L.	Sep 26/00	Gillnet	84	BB	229	63.00	.	J	84	.	2	.
Gwillim L.	Sep 26/00	Gillnet	85	BB	219	61.30	.	J	85	.	2	.
Gwillim L.	Sep 26/00	Gillnet	86	BB	215	55.20	.	J	86	.	2	.
Gwillim L.	Sep 26/00	Gillnet	87	BB	310	175.00	.	J	87	.	3	.
Gwillim L.	Sep 26/00	Gillnet	88	BB	284	125.30	.	J	88	.	3	.
Gwillim L.	Sep 26/00	Gillnet	89	BB	235	67.60	.	J	89	.	2	.
Gwillim L.	Sep 26/00	Gillnet	90	BB	219	61.05	.	J	90	.	2	.
Gwillim L.	Sep 26/00	Gillnet	91	LSU	188	75.85	.	J	.	.		.
Gwillim L.	Sep 26/00	Gillnet	92	LW	84	7.15	.	J	92	1		.
Moberly L.	Sep 27/00	Gillnet	1	LT	761	7800.00	F	M	1	8	11	.
Moberly L.	Sep 27/00	Gillnet	2	LT	810	9050.00	F	M	2	9	12	.
Moberly L.	Sep 27/00	Gillnet	3	LT	739	6500.00	F	M	3	8	13	.
Moberly L.	Sep 27/00	Gillnet	4	LT	704	5500.00	M	M	4	7	15	191.50
Moberly L.	Sep 27/00	Gillnet	5	LT	696	4300.00	M	M	5	7	13	111.00
Moberly L.	Sep 27/00	Gillnet	6	LSU	442	1050.00	.	.	.	.		.
Moberly L.	Sep 27/00	Gillnet	7	LW	385	675.00	F	M	7	9		55.25
Moberly L.	Sep 27/00	Gillnet	8	LW	363	550.00	F	M	8	9		28.95
Moberly L.	Sep 27/00	Gillnet	9	LW	345	525.00	M	M	9	8		4.45
Moberly L.	Sep 27/00	Gillnet	10	LW	291	340.00	F	J	10	7		1.20
Moberly L.	Sep 27/00	Gillnet	11	LW	349	575.00	F	M	11	9		38.85
Moberly L.	Sep 27/00	Gillnet	12	LW	281	290.00	F	J	12	6		1.25
Moberly L.	Sep 27/00	Gillnet	13	LW	278	290.00	M	M	13	5		0.75
Moberly L.	Sep 27/00	Gillnet	14	LW	287	290.00	M	J	14	6		.
Moberly L.	Sep 27/00	Gillnet	15	LW	255	245.00	F	J	15	5		.
Moberly L.	Sep 27/00	Gillnet	16	LW	223	262.00	.	.	16	4		.
Moberly L.	Sep 27/00	Gillnet	17	LW	215	110.80	.	.	17	3		.
Moberly L.	Sep 27/00	Gillnet	18	LW	205	98.65	.	.	18	3		.
Moberly L.	Sep 27/00	Gillnet	19	LW	280	290.00	M	J	9	6		.
Moberly L.	Sep 27/00	Gillnet	20	LW	201	110.00	.	.	20	2		.
Moberly L.	Sep 27/00	Gillnet	21	LW	144	31.70	.	.	21	2		.
Moberly L.	Sep 27/00	Gillnet	22	LW	134	26.40	.	.	22	2		.
Moberly L.	Sep 27/00	Gillnet	23	LW	110	14.80	.	.	23	1		.
Moberly L.	Sep 27/00	Gillnet	24	LW	111	17.75	.	.	24	1		.

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Sep 27/00	Gillnet	25	LW	122	19.15	.	.	25	1		.
Moberly L.	Sep 27/00	Gillnet	26	LW	105	10.80	.	.	26	1		.
Moberly L.	Sep 27/00	Gillnet	27	LW	114	14.80	.	.	.	1		.
Moberly L.	Sep 27/00	Gillnet	28	LW	103	11.20	.	.	28	1		.
Moberly L.	Sep 27/00	Gillnet	29	LW	112	15.40	.	.	29	1		.
Moberly L.	Sep 27/00	Gillnet	30	CSU	111	15.55	.	.	.	.		.
Moberly L.	Sep 27/00	Gillnet	31	LSU	210	155.00	.	.	.	.		.
Moberly L.	Sep 27/00	Gillnet	32	LSU	331	495.00	.	.	.	.		.
Moberly L.	Sep 27/00	Gillnet	33	LT	470	1125.00	F	J	33	5	6	.
Moberly L.	Sep 27/00	Gillnet	34	LW	307	405.00	F	M	34	7		13.00
Moberly L.	Sep 27/00	Gillnet	35	LW	295	365.00	F	M	35	5		11.25
Moberly L.	Sep 27/00	Gillnet	36	LW	298	360.00	M	M	36	5		2.40
Moberly L.	Sep 27/00	Gillnet	37	LW	310	395.00	M	M	37	6		3.15
Moberly L.	Sep 27/00	Gillnet	38	LW	291	320.00	M	M	38	5		0.80
Moberly L.	Sep 27/00	Gillnet	39	LW	257	220.00	F	J	39	4		.
Moberly L.	Sep 27/00	Gillnet	40	LW	269	270.00	M	J	40	5		.
Moberly L.	Sep 27/00	Gillnet	41	LW	285	345.00	F	M	41	5		12.35
Moberly L.	Sep 27/00	Gillnet	42	LW	295	350.00	F	M	42	6		11.35
Moberly L.	Sep 27/00	Gillnet	43	LW	280	295.00	M	J	43	5		.
Moberly L.	Sep 27/00	Gillnet	44	LW	282	270.00	M	J	44	5		.
Moberly L.	Sep 27/00	Gillnet	45	LW	257	225.00	M	J	45	4		.
Moberly L.	Sep 27/00	Gillnet	46	LW	383	925.00	F	M	46	9		57.40
Moberly L.	Sep 27/00	Gillnet	47	LW	288	285.00	M	J	47	5		.
Moberly L.	Sep 27/00	Gillnet	48	LW	282	310.00	F	M	48	5		13.60
Moberly L.	Sep 27/00	Gillnet	49	LW	250	200.00	M	J	49	4		.
Moberly L.	Sep 27/00	Gillnet	50	LW	249	215.00	M	J	50	5		.
Moberly L.	Sep 27/00	Gillnet	51	LW	271	270.00	M	J	51	5		.
Moberly L.	Sep 27/00	Gillnet	52	LW	297	340.00	M	J	52	6		.
Moberly L.	Sep 27/00	Gillnet	53	LW	273	260.00	F	J	53	5		.
Moberly L.	Sep 27/00	Gillnet	54	LW	253	220.00	F	J	54	4		.
Moberly L.	Sep 27/00	Gillnet	55	LW	260	205.00	M	J	55	4		.
Moberly L.	Sep 27/00	Gillnet	56	LW	193	81.80	.	J	56	3		.
Moberly L.	Sep 27/00	Gillnet	57	LW	169	53.15	.	J	57	2		.
Moberly L.	Sep 27/00	Gillnet	58	LW	200	92.35	.	J	58	2		.
Moberly L.	Sep 27/00	Gillnet	59	LW	194	83.15	.	J	59	2		.
Moberly L.	Sep 27/00	Gillnet	60	LW	179	61.65	.	J	60	2		.
Moberly L.	Sep 27/00	Gillnet	61	LW	172	59.40	.	J	61	2		.
Moberly L.	Sep 27/00	Gillnet	62	LW	152	36.20	.	J	.	.		.
Moberly L.	Sep 27/00	Gillnet	63	LW	145	32.20	.	J	63	1		.
Moberly L.	Sep 27/00	Gillnet	64	LW	151	36.75	.	J	64	1		.
Moberly L.	Sep 27/00	Gillnet	65	LW	155	40.35	.	J	65	1		.
Moberly L.	Sep 27/00	Gillnet	66	LW	216	126.75	.	J	66	2		.
Moberly L.	Sep 27/00	Gillnet	67	LW	177	65.10	.	J	67	2		.
Moberly L.	Sep 27/00	Gillnet	68	LW	146	30.45	.	J	68	1		.
Moberly L.	Sep 27/00	Gillnet	69	LW	144	30.65	.	J	69	1		.
Moberly L.	Sep 27/00	Gillnet	70	LW	253	235.00	F	J	70	3		.
Moberly L.	Sep 27/00	Gillnet	71	LW	329	460.00	F	M	71	.		28.30
Moberly L.	Sep 27/00	Gillnet	72	LW	278	280.00	M	J	72	4		
Moberly L.	Sep 27/00	Gillnet	73	LW	283	320.00	M	J	73	5		
Moberly L.	Sep 27/00	Gillnet	74	LW	210	105.75	.	J	74	2		
Moberly L.	Sep 27/00	Gillnet	75	LW	178	71.10	.	J	75	2		
Moberly L.	Sep 27/00	Gillnet	76	LW	169	70.20	.	J	76	2		
Moberly L.	Sep 27/00	Gillnet	77	LW	174	64.30	.	J	77	2		
Moberly L.	Sep 27/00	Gillnet	78	LW	186	79.40	.	J	78	2		
Moberly L.	Sep 27/00	Gillnet	79	LW	167	60.95	.	J	79	2		
Moberly L.	Sep 27/00	Gillnet	80	LW	172	64.80	.	J	80	2		

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Sep 27/00	Gillnet	81	LW	180	72.30	.	J	81	2		
Moberly L.	Sep 27/00	Gillnet	82	LW	181	70.70	.	J	82	2		
Moberly L.	Sep 27/00	Gillnet	83	LW	140	32.10	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	84	LW	175	64.65	.	J	84	2		
Moberly L.	Sep 27/00	Gillnet	85	LW	176	66.65	.	J	85	2		
Moberly L.	Sep 27/00	Gillnet	86	LW	173	68.55	.	J	86	2		
Moberly L.	Sep 27/00	Gillnet	87	LW	169	62.15	.	J	87	2		
Moberly L.	Sep 27/00	Gillnet	88	LW	179	72.45	.	J	88	2		
Moberly L.	Sep 27/00	Gillnet	89	LW	168	53.50	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	90	LW	181	62.95	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	91	LW	182	70.10	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	92	LW	160	49.40	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	93	LW	177	56.55	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	94	LW	169	64.85	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	95	LW	174	63.30	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	96	LW	155	37.90	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	97	LW	178	62.05	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	98	LW	182	70.70	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	99	LW	174	67.70	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	100	LW	184	63.70	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	101	LW	170	69.70	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	102	LW	179	71.75	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	103	LW	165	48.15	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	104	LW	170	63.85	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	105	LW	157	45.20	.	J	105	2		
Moberly L.	Sep 27/00	Gillnet	106	LW	121	21.80	.	J	106	1		
Moberly L.	Sep 27/00	Gillnet	107	LW	118	18.05	.	J	107	1		
Moberly L.	Sep 27/00	Gillnet	108	LW	118	18.05	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	109	LW	119	18.50	.	J	109	1		
Moberly L.	Sep 27/00	Gillnet	110	LW	119	18.75	.	J	110	1		
Moberly L.	Sep 27/00	Gillnet	111	LW	107	13.40	.	J	111	.		
Moberly L.	Sep 27/00	Gillnet	112	LW	107	12.25	.	J	.	.		
Moberly L.	Sep 27/00	Gillnet	113	LW	126	21.75	.	J	113	1		
Moberly L.	Sep 27/00	Gillnet	114	LT	430	900.00	.	J	114	5	6	
Moberly L.	Sep 27/00	Gillnet	115	BB	495	750.00	.	.	.	.	6	
Moberly L.	Sep 27/00	Gillnet	116	LSU	447	1200.00	.	A	.	.		
Moberly L.	Sep 27/00	Gillnet	117	NP	485	900.00	M	M	117	5		
Moberly L.	Sep 27/00	Gillnet	118	NP	414	600.00	M	M	118	4		
Moberly L.	Sep 27/00	Gillnet	119	NP	545	1175.00	M	M	119	6		
Moberly L.	Sep 27/00	Gillnet	120	BB	666	2200.00	F	A	.	.		
Moberly L.	Sep 27/00	Gillnet	121	LSU	310	410.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	122	LSU	415	1150.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	123	LW	361	600.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	124	LW	290	350.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	125	LW	300	315.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	126	LW	207	102.85		.	.	.		
Moberly L.	Sep 27/00	Gillnet	127	LW	167	53.70		.	.	.		
Moberly L.	Sep 27/00	Gillnet	128	LW	172	55.95		.	.	.		
Moberly L.	Sep 27/00	Gillnet	129	LW	378	750.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	130	LW	299	350.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	131	LW	340	525.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	132	LW	253	225.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	133	LSU	315	450.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	134	LSU	261	245.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	135	LSU	265	265.00		.	.	.		
Moberly L.	Sep 27/00	Gillnet	136	LW	217	110.55		.	.	.		

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-unity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Sep 27/00	Gillnet	137	LW	180	65.35						
Moberly L.	Sep 27/00	Gillnet	138	LW	253	205.00						
Moberly L.	Sep 27/00	Gillnet	139	LW	290	350.00						
Moberly L.	Sep 27/00	Gillnet	140	LW	175	65.05						
Moberly L.	Sep 27/00	Gillnet	141	LW	170	56.95						
Moberly L.	Sep 27/00	Gillnet	142	LW	296	33.00						
Moberly L.	Sep 27/00	Gillnet	143	LW	289	315.00						
Moberly L.	Sep 27/00	Gillnet	144	LW	173	57.80						
Moberly L.	Sep 27/00	Gillnet	145	LW	295	300.00						
Moberly L.	Sep 27/00	Gillnet	146	LW	212	111.90						
Moberly L.	Sep 27/00	Gillnet	147	LW	315	425.00						
Moberly L.	Sep 27/00	Gillnet	148	LW	265	270.00						
Moberly L.	Sep 27/00	Gillnet	149	LW	296	360.00						
Moberly L.	Sep 27/00	Gillnet	150	LW	248	225.00						
Moberly L.	Sep 27/00	Gillnet	151	LW	305	410.00						
Moberly L.	Sep 27/00	Gillnet	152	LW	306	340.00						
Moberly L.	Sep 27/00	Gillnet	153	LW	270	270.00						
Moberly L.	Sep 27/00	Gillnet	154	LW	240	170.00						
Moberly L.	Sep 27/00	Gillnet	155	LW	225	127.35						
Moberly L.	Sep 27/00	Gillnet	156	LW	210	109.40						
Moberly L.	Sep 27/00	Gillnet	157	LW	206	109.40						
Moberly L.	Sep 27/00	Gillnet	158	LW	203	87.80						
Moberly L.	Sep 27/00	Gillnet	159	LW	157	46.35						
Moberly L.	Sep 27/00	Gillnet	160	LW	174	64.70						
Moberly L.	Sep 27/00	Gillnet	161	LW	190	88.25						
Moberly L.	Sep 27/00	Gillnet	162	LSU	157	53.25						
Moberly L.	Sep 27/00	Gillnet	163	LSU	256	235.00						
Moberly L.	Sep 27/00	Gillnet	164	LW	214	120.75						
Moberly L.	Sep 27/00	Gillnet	165	LW	282	300.00						
Moberly L.	Sep 27/00	Gillnet	166	LW	116	18.55						
Moberly L.	Sep 27/00	Gillnet	167	LW	111	13.90						
Moberly L.	Sep 27/00	Gillnet	168	LW	131	24.35						
Moberly L.	Sep 27/00	Gillnet	169	LW	99	11.25						
Moberly L.	Sep 27/00	Gillnet	170	LW	117	17.55						
Moberly L.	Sep 27/00	Gillnet	171	LW	126	20.55						
Moberly L.	Sep 27/00	Gillnet	172	LW	110	13.75						
Moberly L.	Sep 27/00	Gillnet	173	LW	123	20.40						
Moberly L.	Sep 27/00	Gillnet	174	LW	108	14.00						
Moberly L.	Sep 27/00	Gillnet	175	LW	120	19.85						
Moberly L.	Sep 27/00	Gillnet	176	LW	116	14.85						
Moberly L.	Sep 27/00	Gillnet	177	LW	172	20.05						
Moberly L.	Sep 27/00	Gillnet	178	LW	111	15.25						
Moberly L.	Sep 27/00	Gillnet	179	LW	125	18.65						
Moberly L.	Sep 27/00	Gillnet	180	LW	116	15.75						
Moberly L.	Sep 27/00	Gillnet	181	LW	118	17.10						
Moberly L.	Sep 27/00	Gillnet	182	LW	106	13.60						
Moberly L.	Sep 27/00	Gillnet	183	LW	115	15.70						
Moberly L.	Sep 27/00	Gillnet	184	LW	120	17.05						
Moberly L.	Sep 27/00	Gillnet	185	LW	118	16.10						
Moberly L.	Sep 27/00	Gillnet	186	LW	110	14.35						
Moberly L.	Sep 27/00	Gillnet	187	LW	118	16.80						
Moberly L.	Sep 27/00	Gillnet	188	LW	120	18.85						
Moberly L.	Sep 27/00	Gillnet	189	LW	121	19.50						
Moberly L.	Sep 27/00	Gillnet	190	LW	117	16.40						
Moberly L.	Sep 27/00	Gillnet	191	LW	110	15.05						
Moberly L.	Sep 27/00	Gillnet	192	LW	177	61.35						

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Sep 27/00	Gillnet	193	LT	460	1200.00	.	J	.	5	6	.
Moberly L.	Sep 27/00	Gillnet	194	LW	130	25.45	.	.	.	.		.
Moberly L.	Sep 27/00	Gillnet	195	LW	120	17.30	.	.	.	.		.
Moberly L.	Sep 27/00	Gillnet	196	LW								
Moberly L.	Sep 27/00	Gillnet	197	LT								
Moberly L.	Sep 28/00	Gillnet	1	LT	393	725.00	.	J	1	4	5	.
Moberly L.	Sep 28/00	Gillnet	2	LT	580	2400.00	M	M	2	6	9	92.90
Moberly L.	Sep 28/00	Gillnet	3	LT	707	4500.00	M	M	3	8	11	149.20
Moberly L.	Sep 28/00	Gillnet	4	LT	717	4600.00	F	M	4	8	11	82.50
Moberly L.	Sep 28/00	Gillnet	5	LT	791	8000.00	.	.	5	9	17	110.00
Moberly L.	Sep 28/00	Gillnet	6	LT	641	2800.00	.	.	6	7	11	58.75
Moberly L.	Sep 28/00	Gillnet	7	LSU	397	1075.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	8	LSU	314	405.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	9	LSU	334	485.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	10	LSU	408	925.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	11	LW	332	490.00	M	M	11	7		.
Moberly L.	Sep 28/00	Gillnet	12	LW	293	375.00	M	M	12	6		.
Moberly L.	Sep 28/00	Gillnet	13	LW	322	445.00	M	M	13	6		.
Moberly L.	Sep 28/00	Gillnet	14	LW	284	295.00	F	M	14	6		.
Moberly L.	Sep 28/00	Gillnet	15	LW	211	121.65	.	J	15	2		.
Moberly L.	Sep 28/00	Gillnet	16	LW	228	165.00	.	J	16	3		.
Moberly L.	Sep 28/00	Gillnet	17	LW	215	125.00	.	J	17	2		.
Moberly L.	Sep 28/00	Gillnet	18	LW	206	93.95	.	J	18	2		.
Moberly L.	Sep 28/00	Gillnet	19	LW	139	28.00	.	J	19	1		.
Moberly L.	Sep 28/00	Gillnet	20	LW	113	13.20	.	J	20	1		.
Moberly L.	Sep 28/00	Gillnet	21	LW	115	16.80	.	J	21	1		.
Moberly L.	Sep 28/00	Gillnet	22	LW	116	54.30	.	J	22	1		.
Moberly L.	Sep 28/00	Gillnet	23	LW	64	2.10	.	J	23	0		.
Moberly L.	Sep 28/00	Gillnet	24	LSU	415	1025.00	.	J	24	.		.
Moberly L.	Sep 28/00	Gillnet	25	NP	576	1200.00	F	M	25	.		.
Moberly L.	Sep 28/00	Gillnet	26	NP	471	825.00	M	M	26	.		.
Moberly L.	Sep 28/00	Gillnet	27	NP	484	975.00	M	M	27	.		.
Moberly L.	Sep 28/00	Gillnet	28	NP	555	1325.00	M	M	28	.		.
Moberly L.	Sep 28/00	Gillnet	29	LW	360	650.00	M	M	29	7		13.35
Moberly L.	Sep 28/00	Gillnet	30	LW	287	325.00	F	M	30	6		19.75
Moberly L.	Sep 28/00	Gillnet	31	LW	300	315.00	M	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	32	LW	279	285.00	F	M	.	.		14.30
Moberly L.	Sep 28/00	Gillnet	33	LW	289	320.00	F	J	33	.		2.45
Moberly L.	Sep 28/00	Gillnet	34	LW	274	275.00	M	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	35	LW	298	350.00	F	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	36	LW	293	355.00	M	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	37	LW	308	365.00	M	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	38	LW	241	180.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	39	LW	287	320.00	M	J	39	5		.
Moberly L.	Sep 28/00	Gillnet	40	LW	300	345.00	F	J	40	6		.
Moberly L.	Sep 28/00	Gillnet	41	LW	294	330.00	M	M	41	6		.
Moberly L.	Sep 28/00	Gillnet	42	LW	278	285.00	F	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	43	LW	240	170.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	44	LW	167	52.95	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	45	LW	343	550.00	M	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	46	LW	302	380.00	M	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	47	LW	172	53.90	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	48	LSU	418	1000.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	49	LW	300	340.00	M	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	50	BB	419	380.00	.	.	.	.	4	.
Moberly L.	Sep 28/00	Gillnet	51	LT	488	1450.00	.	J	51	.	6	.

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale No.	Scale Age	Otolith Age	Gonad Wt (g)
Moberly L.	Sep 28/00	Gillnet	52	LT	501	1900.00	.	J	52	.	6	.
Moberly L.	Sep 28/00	Gillnet	53	LT	430	925.00	F	J	53	.	6	.
Moberly L.	Sep 28/00	Gillnet	54	LSU	324	495.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	55	LW	285	305.00	F	M	55	5		.
Moberly L.	Sep 28/00	Gillnet	56	LW	224	160.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	57	LW	175	57.50	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	58	LW	168	51.65	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	59	LW	182	73.60	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	60	LW	119	18.50	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	61	LW	174	57.75	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	62	LW	116	17.60	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	63	LSU	239	180.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	64	LW	210	114.50	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	65	LW	302	355.00	F	M	55	9		.
Moberly L.	Sep 28/00	Gillnet	66	LW	324	470.00	F	M	56	7		.
Moberly L.	Sep 28/00	Gillnet	67	LW	276	275.00	F	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	68	LW	169	56.75	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	69	LW	170	61.75	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	70	LW	212	121.85	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	71	LW	171	60.70	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	72	LW	175	59.45	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	73	LW	151	35.65	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	74	NP	381	320.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	75	NP	436	600.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	76	NP	440	600.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	77	NP	467	825.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	78	NP	482	900.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	79	NP	575	1350.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	80	NP	485	850.00	.	.	.	.		.
Moberly L.	Sep 28/00	Gillnet	81	BB	340	320.00	.	.	.	.	4	.
Moberly L.	Sep 28/00	Gillnet	82	BB	518	725.00	.	.	.	.	7	.
Moberly L.	Sep 28/00	Gillnet	83	LW	244	200.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	84	LW	296	320.00	F	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	85	LW	269	285.00	M	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	86	LW	288	345.00	M	M	.	.		.
Moberly L.	Sep 28/00	Gillnet	87	LW	275	280.00	M	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	88	LW	286	300.00	M	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	89	LW	282	270.00	F	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	90	LW	239	190.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	91	LW	253	215.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	92	LW	228	170.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	93	LW	216	135.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	94	LW	198	91.80	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	95	LW	164	53.95	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	96	LW	151	32.90	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	97	LW	170	53.75	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	98	LW	178	58.00	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	99	LW	146	32.65	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	100	LW	155	33.40	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	101	LW	125	21.25	.	J	.	.		.
Moberly L.	Sep 28/00	Gillnet	102	LW	161	53.00	.	J	.	.		.
Moberly L.	Sep 29/00	Gillnet	1	NP	502	825.00	M	M	.	.		.
Moberly L.	Sep 29/00	Gillnet	2	NP	353	295.00	F	M	.	.		.
Moberly L.	Sep 29/00	Gillnet	3	LSU								

Appendix V: Fish sample analysis

System	Date/ Time	Capture Method	Fish No.	Species	Length (fork mm)	Weight (g)	Sex	Mat-urity	Scale		Otolith Age	Gonad Wt (g)
									No.	Age		
Moberly L.	Sep 29/00	Gillnet	4	WF								
Moberly L.	Sep 29/00	Gillnet	5	WF								
Moberly L.	Sep 29/00	Gillnet	6	WF								
Moberly L.	Sep 29/00	Gillnet	7	WF								
Moberly L.	Sep 29/00	Gillnet	8	WF								
Moberly L.	Sep 29/00	Gillnet	9	WF								
Moberly L.	Sep 29/00	Gillnet	10	WF								
Moberly L.	Sep 29/00	Gillnet	11	WF								
Moberly L.	Sep 29/00	Gillnet	12	WF								
Moberly L.	Sep 29/00	Gillnet	13	WF								
Moberly L.	Sep 29/00	Gillnet	14	WF								
Moberly L.	Sep 29/00	Gillnet	15	WF								
Moberly L.	Sep 29/00	Gillnet	16	WF								
Moberly L.	Sep 29/00	Gillnet	17	WF								
Moberly L.	Sep 29/00	Gillnet	18	WF								
Moberly L.	Sep 29/00	Gillnet	19	WF								
Moberly L.	Sep 29/00	Gillnet	20	WF								
Moberly L.	Sep 29/00	Gillnet	21	WF								
Moberly L.	Sep 29/00	Gillnet	22	WF								
Moberly L.	Sep 29/00	Gillnet	23	WF								
Moberly L.	Sep 29/00	Gillnet	24	WF								
Moberly L.	Sep 29/00	Gillnet	25	WF								
Moberly L.	Sep 29/00	Gillnet	26	WF								
Moberly L.	Sep 29/00	Gillnet	27	WF								
Moberly L.	Sep 29/00	Gillnet	28	WF								